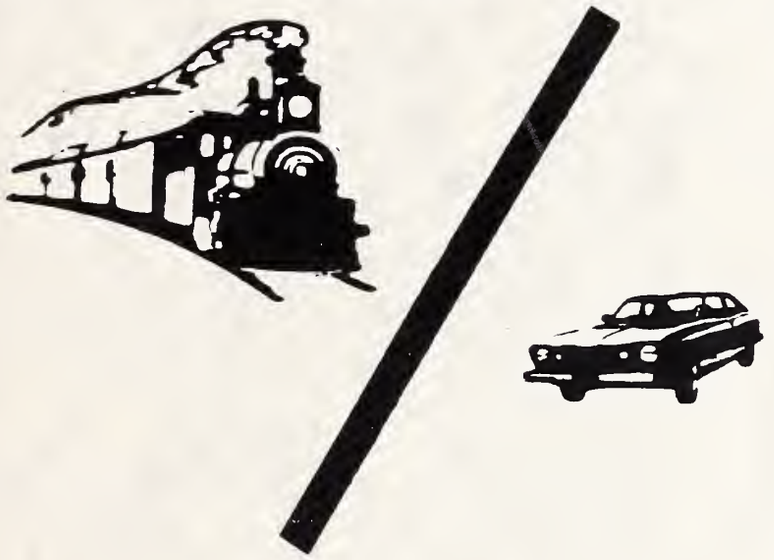
S
625.72
M26tsN
1985

TRAFFIC STUDY NORTH OF COLUMBIA FALLS

PLEASE RETURN



OCTOBER, 1985

STATE DOCUMENTS COLLECTION

AUG 12 19[illegible]

MONTANA STATE LIBRARY
1515 E 6th AVE.
HELENA, MONTANA 59620

Prepared For

FLATHEAD REGIONAL DEVELOPMENT OFFICE

PREPARED BY

CLETE DAILY & ASSOCIATES

Helena, Montana

MONTANA STATE LIBRARY
S 625.72 M26tsn 1985 c.1
Traffic study north of Columbia Falls :f
3 0864 00053441 5

TRAFFIC STUDY NORTH OF COLUMBIA FALLS

FINAL REPORT

OCTOBER 1985

Submitted To:

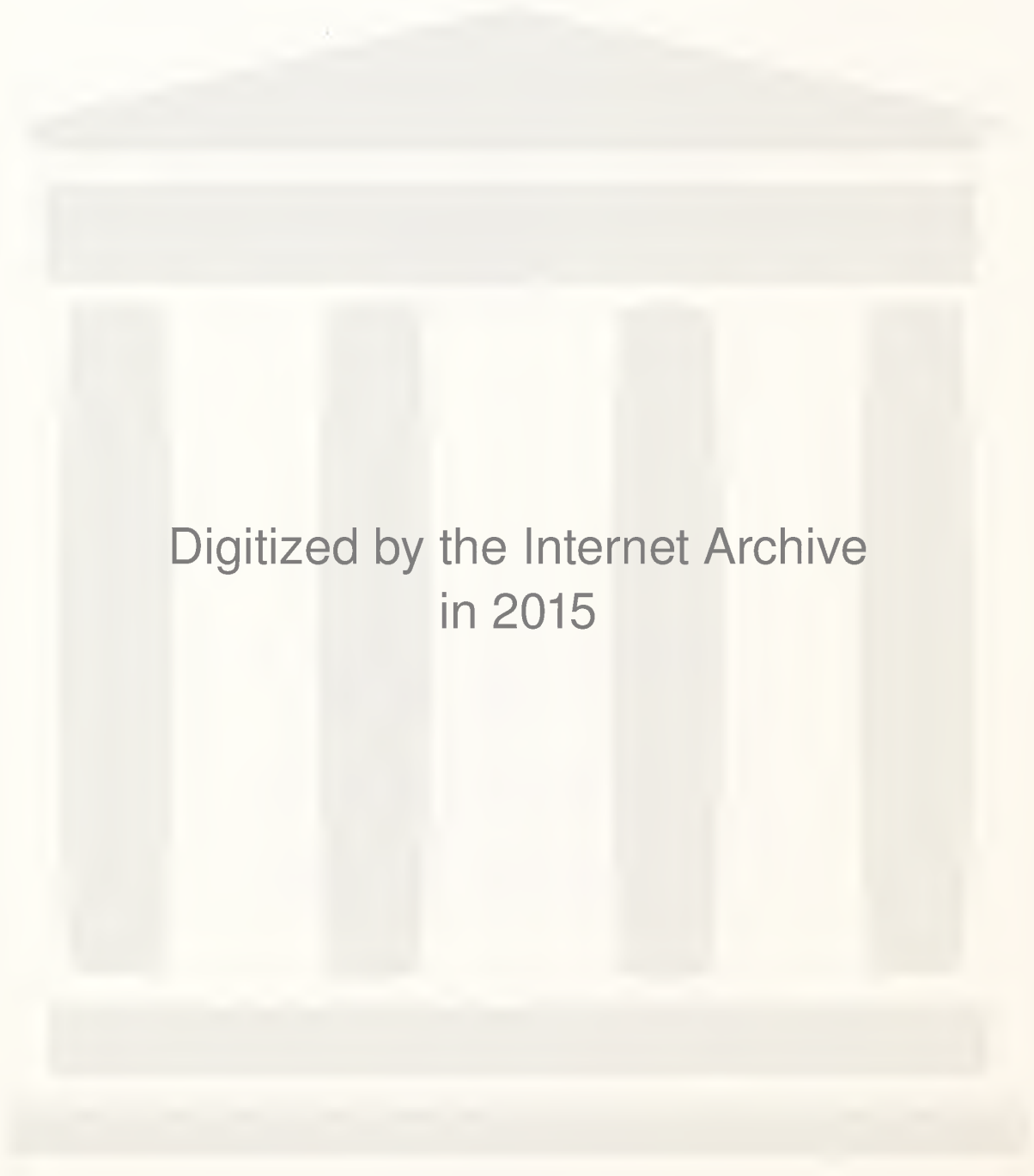
Flathead Regional Development Office
Kalispell, Montana
In Cooperation With:

Traffic Safety Division
Montana Department of Justice
and
Plum Creek Lumber Company
Columbia Falls, Montana

Prepared By:

Clete Daily and Associates
P.O. Box 223
Helena, Montana 59624

MONTANA STATE LIBRARY
1515 E. 6th AVE.
HELENA, MONTANA 59620


Digitized by the Internet Archive
in 2015

https://archive.org/details/trafficstudynort1985clet

TABLE OF CONTENTS

		Page
I.	INTRODUCTION	1
	A. Existing Land Use	4
	B. Existing Railroad Crossings	4
II.	TRAFFIC	6
	A. Average Daily Vehicular Traffic	7
	B. Turning Movements	9
	C. Pedestrian and Bicycle Traffic	10
	D. Traffic Delays	12
	E. Future Traffic Volumes	12
III.	SAFETY	15
	A. Accident Description	17
	B. Emergency Access	21
IV.	ALTERNATIVE CROSSING ANALYSIS	23
	A. Optimum Crossing Location	24
	B. Estimated Traffic Volumes	26
	C. General Evaluation of Alternative Crossings	34
	D. Cost Estimates	42
	E. Benefit/Cost Analysis	43
	1. User Delay at Railroad Crossings and Plum Creek	43
	2. User Travel Distance Due to Crossing Location	45
	3. Accident Costs	46
	4. Summary	47
	F. Recommended Alternative	47
V.	RECOMMENDED IMPROVEMENT PLAN	49
	A. Short Range Improvement Plans	50
	B. Long Range Improvement Plans	60
VI.	FUNDING	64
	A. Funding Sources	65
	B. Funding Schedules	68
APPENDIX:	TRIP GENERATION AND TRAFFIC ASSIGNMENT MODEL	69

LIST OF TABLES

Page

Table 1: 1985 Traffic Volumes. 7

Table 2: Pedestrian and Bicycle Traffic -- Sixteen Hour Counts 10

Table 3: Pedestrian and Bicycle Traffic -- 7:30 AM-9:30 AM, 11:30 AM-1:30 PM, and 3:30 PM-6:30 AM 11

Table 4: Vehicle Delay Times 12

Table 5: Railroad Crossing Traffic Projections 13

Table 6: Railroad Crossing Traffic Projections: 12th Avenue West Closure. 14

Table 7: Accidents -- 1981-1984. 16

Table 8: Ambulance and Fire Department Responses -- 1983-1985 21

Table 9: Optimum Crossing Locations. 24

Table 10: Estimated Traffic Volumes -- Alternative Crossings 26

Table 11: Soils Limitations for Community Roads 41

Table 12: Cost Estimates: 1985 Dollars 42

Table 13: User Delay Costs: 1985 - Full Development. 44

Table 14: User Delay Cost Reduction: 1985 - Full Development. 44

Table 15: Distance From Optimum Location. 45

Table 16: Accident Reduction Benefit. 46

Table 17: Annual Benefit/Cost Ratios. 47

Table 18: Short Range Improvements Cost Summary 59

Table 19: Long Range Improvements Cost Summary. 62

Table 20: Short-Term Improvement Funding Schedule 68

Table 21: Long-Term Improvement Funding Schedule. 68

LIST OF FIGURES

Page

Figure 1: Study Area 3

Figure 2: 1985 Traffic Volumes, 1981-1984 Accident Locations, and 1982-1985 Emergency Response Locations. 8

Figure 3: Alternative Crossing Sites 27

Figure 4: Site #1: Extension of N. Hilltop Road 28

Figure 5: Site #2: Extension of Meadow Lake Drive 29

Figure 6: Site #3: Extension of Rocky Lane. 30

Figure 7: Site #5: 12th Avenue West 31

Figure 8: Site #6: Extension of 4th Avenue West 32

Figure 9: Site #7: Extension of Nucleus Avenue. 33

Figure 10: Site #8: West Leg of Tamarack Lane & 4th Avenue West. 51

Figure 11: Site #9: 2nd Avenue West. 53

Figure 12: Site #10: 4th Avenue East. 54

Figure 13: 4th Avenue W.N. & 4th Street N 56

Figure 14: 12th Avenue W.N. & Tamarack Lane 58

Figure 15: Improvement Plan 63

I. INTRODUCTION

I. INTRODUCTION

This report documents the major findings of a three month study of the traffic system serving the Columbia Falls area north of the Burlington Northern Railroad tracks. Figure 1 shows the study area boundaries.

The study was initiated in May, 1985 when the Flathead Regional Development Office advertized for a consulting firm to conduct a traffic operations study for the north Columbia Falls area. A committee selected the firm of Clete Daily and Associates to carry out the study. Funding was jointly provided by Flathead County; Montana Department of Justice, Traffic Safety Division; and Plum Creek Lumber Company.

The consultant started work on July 10, 1985. A steering committee was formed to review the consultant's findings and to provide local, county and state agency input as the project progressed. The steering committee was made up of the following members:

Nakul S. Verma -- Planning Director, Flathead Regional Development Office

Allan Jackobson -- Flathead County Commissioner

Harry Lauer -- Traffic Engineer, Montana Department of Justice, Traffic Safety Division

Colleen Allison -- Mayor, Columbia Falls

Peter Tracy -- Owner, Meadow Lake Country Club

Robert Beckley -- Manager, Western Sawmill Operations, Plum Creek Lumber Company

William Knapton -- Homeowners representative

A series of five steering committee and three public meetings were held to present information and to obtain input, as the project progressed.

This document is the culmination of these efforts.

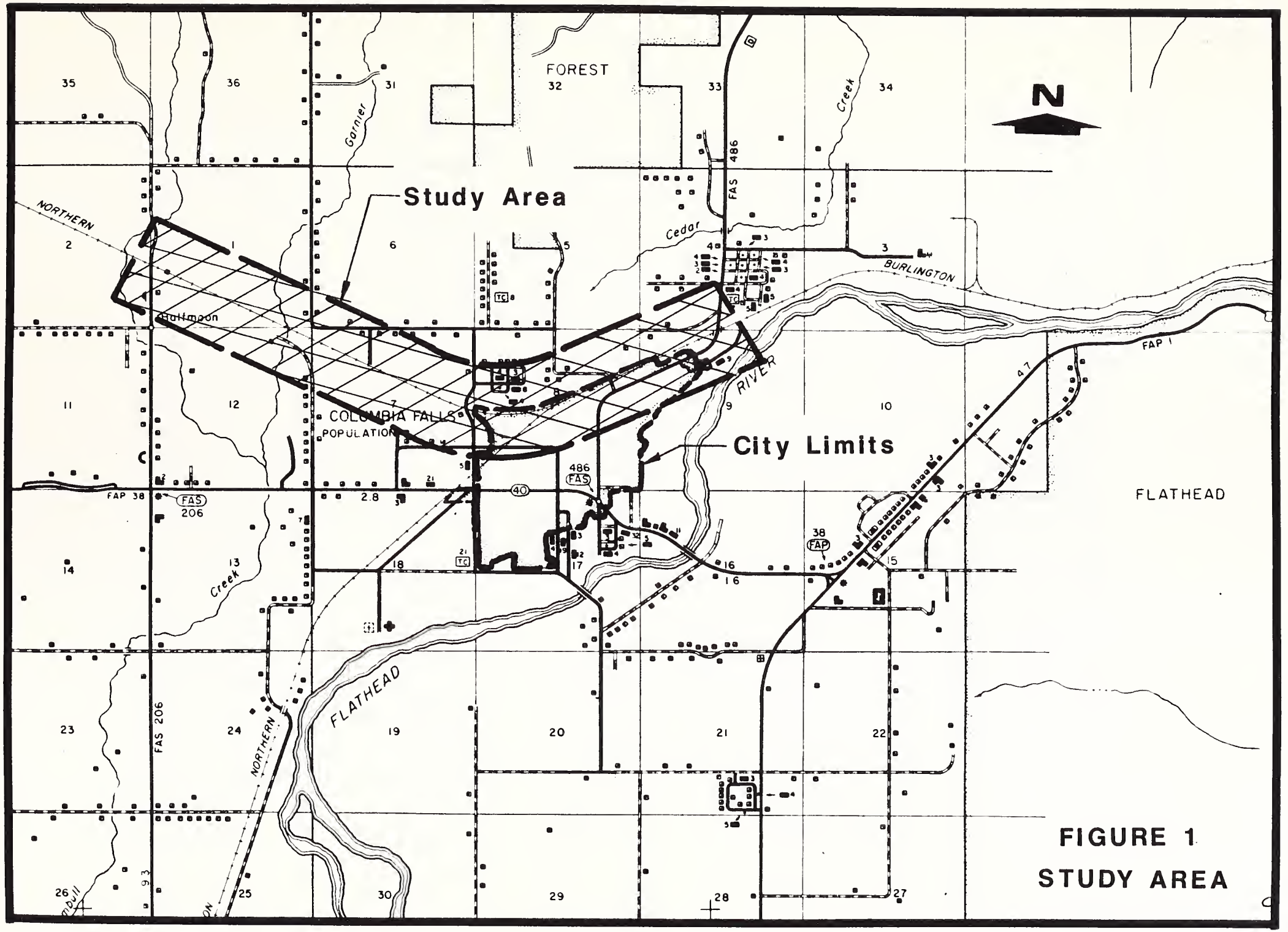


FIGURE 1
STUDY AREA

A. Existing Land Use

The land use north of the Burlington Northern Railroad tracks consists of scattered, rural residential units; residential subdivisions; Meadow Lake Golf Course; and the Superior Building Company. The residential subdivisions are:

- Country Estates Mobile Home Park
- Vetville Subdivision
- Meadow Lake Estates Subdivision

Country Club Estates and Vetville are older developments, Meadow Lake Estates is a phased development which, when fully developed, could have a total of 566 residential units.

B. Existing Railroad Crossings

The area north of the Burlington Northern Railroad tracks is presently served by three at-grade railroad crossings located at 12th Avenue West, 2nd Avenue West, and 4th Avenue East. All three crossings are controlled by automatic crossing gates.

The 12th Avenue West crossing carries 49 percent of the total traffic using the three crossings. This route provides direct access to the Vetville subdivision and is signed as the main access route to the Meadow Lake Country Club and Golf Course.

The 2nd Avenue West crossing carries 31 percent of the traffic to the area north of the tracks. This crossing serves the residential areas east of 12th Avenue West. During periods when roads are icy or snowpacked, this crossing primarily serves the area east of 4th Avenue W.N. This is due to the steep hill on the west approach of Tamarack Lane and 4th Avenue W.N. The 12 percent grade on this section of road

makes it difficult to negotiate the hill during much of the winter. This crossing is closed during long intervals when switching is taking place. The geometrics of the crossing are very poor. The north approach has a jog to the east that has resulted in several accidents involving vehicles high-centering on the tracks. The south approach has five approach legs made up of gravel roads that have been located by vehicles taking short cuts from Railroad Street to the crossing. Improvements are recommended for this crossing.

The 4th Avenue East crossing serves the Superior Building Company lumber mill and adjacent residences. This crossing carries 20 percent of the total crossing traffic.

II. TRAFFIC

II. TRAFFIC

A. Average Daily Vehicular Traffic

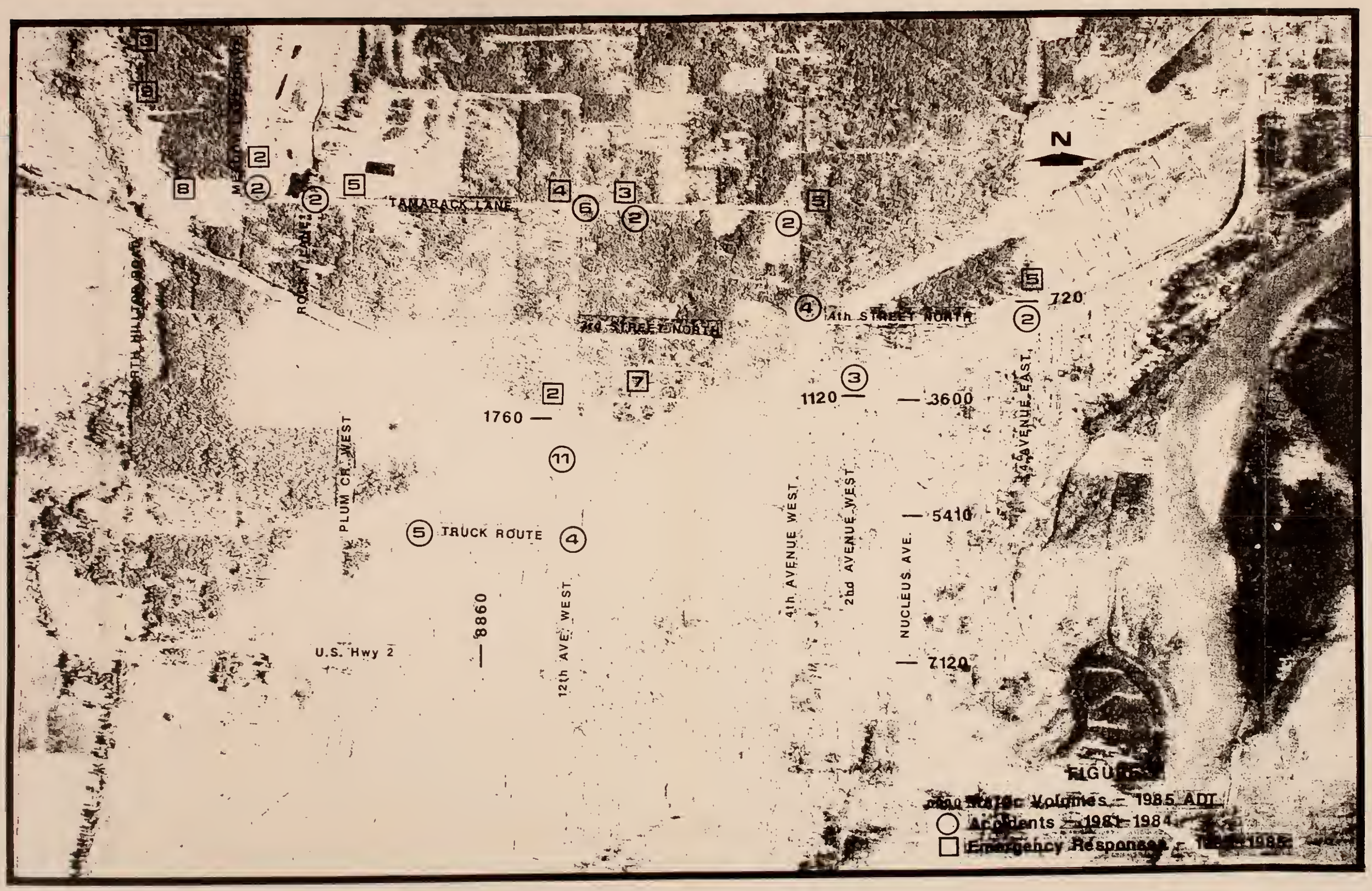
Mechanical traffic counts in the Columbia Falls area were taken by the Montana Department of Highways in 1984. Special counts of the three railroad crossings were taken in 1985. Figure 2 shows area traffic counts which have been adjusted to average daily traffic.

The existing traffic volumes crossing the Burlington Northern tracks at the three existing crossings are as follows:

Table 1
1985 Traffic Volumes

Crossing	1985 Average Daily Traffic (ADT)	Percent of Total
12th Avenue West	1,760	48.9%
2nd Avenue West	1,120	31.1%
4th Avenue East	720	20.0%
Total	3,600	100.0%

The crossing at 12th Avenue West carries nearly half the total traffic. The traffic counts shown were taken in May of 1985. During the winter months, the steep hill on the west approach of Tamarack Lane and 4th Avenue West will cause the traffic volumes on the 2nd Avenue West and 4th Avenue East crossings to drop and the diverted traffic to use 12th Avenue West. This factor should be considered in the location of any new crossing. Any location east of 4th Avenue West will have a lower utilization during icy or snowpacked road conditions. There are three possible solutions to this problem:


N
TAMARACK LANE
ROCKY LANE
NORTH HILLTOP ROAD
PLUM CR.
WEST
TRUCK ROUTE
U.S. Hwy 2
8860
1760
12th AVE. WEST
4th AVENUE WEST
2nd AVENUE WEST
NUCLEUS AVE.
5410
7120
1120
3600
720
4th STREET NORTH
4th AVENUE EAST
Traffic Volumes — 1985 ADT
Accidents — 1981-1984
Emergency Response — 1985

FIGURE

1. Locate any new crossings west of 4th Avenue West

2. Reduce the grade on Tamarack at 4th Avenue West

3. Construct an alternative east-west route north of the tracks, eliminating severe grades

B. Turning Movements

Vehicular turning movements were counted to determine the direction of traffic flow at the intersection of the railroad crossings and the major connecting streets.

At the 12th Avenue West crossing, 67 percent of the traffic crossing the tracks is to or from the area west of the intersection of 12th Avenue West and Tamarack Lane and 33 percent to or from areas to the east. On the south side of the tracks, at the intersection of 12th Avenue West and the Truck Route, 31 percent of the traffic using the crossing was to or from the east, six percent was to or from the west and 63 percent moved north or south across the intersection on 12th Avenue West.

At the 2nd Avenue West crossing, south of the tracks, 68 percent of the traffic was to or from the east on Railroad Steet, 25 percent was to or from the west, and seven percent moved north and south across the intersection on 2nd Avenue West.

At the 4th Avenue East crossing, north of the tracks, 49 percent of the traffic crossing the tracks was to or from the west and 51 percent to or from the east.

The following is a summary of the pertinent findings of the turning movement counts.

- The primary function of the 12th Avenue West crossing is to carry traffic from areas on the north side of the tracks to the west of 12th Avenue W.N. to U.S. Highway 2 or areas to the south of U.S. 2.

- The primary function of the 2nd Avenue West crossing is to provide access to the central business district area.

- The 4th Avenue East crossing provides nearly equal traffic access to the Superior Building Company mill and to the residential areas to the west.

C. Pedestrian and Bicycle Traffic

Sixteen hour counts were taken at each of the railroad crossings. Table 2 shows the number of pedestrians and bicycles using each crossing.

Table 2
Pedestrian and Bicycle Traffic -- Sixteen Hour Counts

Crossing	Pedestrians	Bicycles	Total
12th Avenue West	15	19	34
2nd Avenue West	24	8	32
4th Avenue East	3	3	6
Total	42	30	72

In addition to the pedestrian and bicycle counts at the railroad crossings, peak hour counts were taken at 12th Avenue West and the Truck Route, and at 6th Avenue West and the Truck Route. Table 3 shows the results of these counts.

Table 3
Pedestrian and Bicycle Traffic --
7:30 AM-9:30 AM, 11:30 AM-1:30 PM, and 3:30 PM-6:30 AM

Location	Northbound	Southbound	Eastbound	Westbound
12th Avenue W. & Truck Route	26	24	6	10
6th Avenue W. & Truck Route	26	23	6	6

During the time the traffic surveys were being conducted, it was observed that there is considerable vehicular traffic congestion around the school complex on 4th Avenue West. Vehicles dropping off or picking up students were double parked on 6th Avenue West, sometimes four abreast, while children were crossing the street between vehicles. After drop-off or pick-up, many of the vehicles made U-turns in the street. There is a need for a more organized load/unload area in the vicinity of the school complex.

The following is a summary of the pertinent findings of the pedestrian counts.

- The 12th Avenue West crossing had a total of 34 pedestrian and bicycle crossings during the 16-hour period from 6:00 AM to 10:00 PM.
- At the intersection of 12th Avenue West and the Truck Route, 76 percent of the pedestrians and bicycles move north and south. These volumes indicate that the 12th Avenue crossing is used primarily by students bound for the high school and the primary school located south of U.S. 2.
- Approximately 24 percent of the pedestrian and bicycle crossings at 12th Avenue West are destined for the school complex located on the southwest corner of 4th Avenue West and the Truck Route.
- The 2nd Avenue West crossing had nearly as many pedestrian and bicycle crossings as the 12th Avenue West crossing.

- The 4th Avenue West crossing had only six pedestrian and bicycle crossings, or eight percent of the total railroad crossings.

D. Traffic Delays

Delay times for traffic crossing the railroad and for heavy equipment crossings at Plum Creek Lumber Company and 12th Avenue West were measured. Delay times were calculated by taking the time the crossing was closed times the number of vehicles accumulated at the crossing and then dividing by two to get the average time that each vehicle was delayed. Table 4 shows vehicular delays at each of the locations.

Table 4
Vehicle Delay Times

Location	Daily Hours Delay	Annual Hours Delay
12th Avenue W. & RR track	0.5	182
2nd Avenue W. & RR track	7.0	2,555
4th Avenue E. & RR track	11.3	4,124
12th Avenue W. and Plum Creek	4.8	1,248*
Total		8,109

*Assuming a five-day work week.

E. Future Traffic Volumes

Future traffic volumes have been estimated based on the Columbia Falls 1984 Master Plan. The Master Plan estimates that 520 new housing units will be needed from 1980 to 1990, and 460 new units from 1990 to

2000, in order to maintain an adequate housing supply. Using 1980 Census data, it is estimated that 180 new housing units will be constructed north of the tracks between 1980 and 1990, and 160 from 1990 to 2000. These new units were distributed to the traffic analysis zones north of the tracks based on percentage of existing dwelling units and areas of planned development. The zone containing the Meadow Lake Subdivision was allocated 108 new dwelling units by the year 1990, and 106 new units between 1990 and 2000. An estimate of future traffic was also made based on the assumption that the Meadow Lake Subdivision would be fully developed. This amounts to a total of 566 units in the Meadow Lake traffic zone. A traffic assignment model was also developed and used to estimate the distribution of future traffic to the existing and alternative railroad crossings.

The following table shows traffic projections for the existing crossings of the years 1990, 2000, and for full development of the Meadow Lake Subdivisions.

Table 5
Railroad Crossing Traffic Projections

Crossing	1985 ADT	1990 ADT	2000 ADT	Full Development ADT
12th Avenue West	1,760	1,840	3,320	4,210
2nd Avenue West	1,120	1,690	3,130	4,440
4th Avenue East	720	900	1,430	1,520
Halfmoon Road*	200	1,020	2,210	3,890
Total	3,800	5,450	10,010	14,060

*Includes traffic that would take Tamarack Lane to Halfmoon Road and then to U.S. 2. This assumes that Tamarack Lane reconstruction is complete.

Table 5 shows that traffic will increase by 43 percent from 1985 to 1990, and by 84 percent from 1990 to 2000. With full development of Meadow Lake Subdivision, traffic would increase by 156 percent from 1990 to the year development is completed. The traffic volumes generated when Meadow Lake Subdivision is fully developed, would result in increased delay times at the Plum Creek crossing, causing a substantial loss of manhours.

The effect of closing 12th Avenue West is shown in Table 6.

Table 6
Railroad Crossing Traffic Projections:
12th Avenue West Closure

Crossing	1985 ADT	1990 ADT	2000 ADT	Full Development ADT
2nd Avenue West	2,880	2,680	4,950	7,020
4th Avenue East	720	900	1,430	1,520
Halfmoon Road	280	1,870	3,630	5,520
Total	3,800	5,450	10,010	14,060

Table 6 shows that with 12th Avenue West closed and Meadow Lake Subdivision fully developed, the crossing at 2nd Avenue would be carrying over six times the present traffic. During switching periods, it was found that this crossing was closed for long periods of time ranging as high as 46 minutes. When traffic was delayed up to five minutes, most of the vehicles turned around and used an alternate crossing. A few vehicles went around the gates. During long delays at 2nd Avenue West, similar delays also occurred at the 4th Avenue East crossing. With 12th Avenue West closed, vehicles at these two crossings would have no acceptable alternative crossings. Violations of running the gates would increase to unacceptable levels. Traffic to and from U.S. Highway 2 West would use the Tamarack Lane/Halfmoon Road route.

III. SAFETY

III. SAFETY

Accidents provide a source of information that can be used to determine locations where improvements should be made. Montana Highway Patrol records were used to compile accidents occurring along the railroad corridor for the four-year period from 1981 through 1984. Figure 2 shows the locations of accidents in the vicinity of the railroad.

Table 7 shows the location and number of accidents at these locations.

Table 7
Accidents -- 1981-1984

Location	Number of Accidents
12th Avenue West crossing	11
12th Avenue W.N. and Tamarack Lane	6
2nd Avenue West crossing	6
Truck Route and Mills Road	5
12th Avenue West and Truck Route	4
4th Avenue W.N. and 90 degree turn	4
Tamarack Lane and Rock Lane	2
Tamarack Lane and 4th Avenue West	2
Tamarack Lane and Meadow Lake Drive	2
Tamarack Lane and Woodland Road	2
4th Avenue East crossing	1
Total	45

The accidents shown in Table 7 were diagrammed and analyzed. The following is a brief discussion of the findings from the accident analysis. Detailed improvement recommendations are included in Section IV.

A. Accident Description

1. 12th Avenue West Crossing: The eleven accidents at this location occurred between the Truck Route and 2nd Avenue WN.

Three of the accident locations were north of the tracks. Two of these involved collisions with trees along the roadway. The third was a rear-end collision. All occurred during daylight hours. Two were injury accidents.

Six of the accidents occurred at the railroad crossing. Two involved collisions with trains. One of these accidents was a double fatality and two involved injuries. Of the other four accidents, three were due to loss of control and high-center or collision with the railroad tracks. The other involved loss of control and collision with a fixed object. Three accidents were at night and three during the day.

Two accidents were in the Plum Creek Lumber Company area. Both were due to loss of control causing vehicles to leave the road. Both occurred at night.

The accident history on this section of roadway indicates the need for improvements in three general areas:

- Improved roadway surface and drainage in the Plum Creek Lumber Company area.
- Improved roadway surface, widening, and roadway delineation at the railroad crossing.
- Possible realignment, roadway delineation, and clearing of roadside foilage and obstructions along the roadway north of the tracks.

2. 12th Avenue W.N. and Tamarack Lane: Four of the accidents at this intersection were two-vehicle collisions involving vehicles turning onto Tamarack Lane. All were due to speeds that were excessive for roadway conditions. The other two accidents were collisions with trees and involved loss of control. Two of the accidents involved injuries.

General areas for improvement at this location include:

- Advance signing and clearing of roadside obstructions to improve sight distance.
- Widening of intersection approaches.

3. Truck Route and Mills Road: Four of the accidents at this intersection were two-vehicle accidents involving turning vehicles or vehicles failing to yield the right-of-way. The other accident involved a vehicle going out-of- control and leaving the roadway. Two of the accidents involved injuries.

General areas for improvement at this intersection include:

- Improved signing and delineation at the intersection and its approaches.
- Improved superelevation for major movement between south and east legs.

4. 4th Avenue W.N. and 90 Degree Turn: This location is included in the Flathead County accident study, conducted by Peccia and Associates in 1981. The site is listed in that report as site number 16. There were three reported accidents at this site from 1978 through 1980. During the four year period from 1981 through 1984, four more accidents occurred. The recommendations in the Flathead County Accident Study should be implemented. These improvements and a thorough analysis of the site are set forth in the report.

Generally, the recommended improvements included:

- Striping, signing, and delineation
- Remove or prune roadside foilage
- Widen pavement

The cost estimate (1981) for short range improvements was $2,352. In view of the continuing accident rate at this site, the improvement benefit/cost ratio would be more than that shown in the 1981 study. The benefit/cost ratio in 1981 was calculated to be 4.71 or a return in user benefits of $4.71 for every dollar spent on the short-term improvement.

The recommended long-term improvements at this site called for realignment of the roadway to pass on the northeast side of the houses in the northeast quadrant of the curve. The cost of this improvement, excluding 1.4 acres of right-of-way, was $36,400.

5. 2nd Avenue West Railroad Crossing: Three accidents of the six at this location occurred north of the tracks. One involved a collision with a horse and the other two were at the intersection of 2nd Avenue W.N. and 4th Street W.N., and involved a vehicle failing to stop or turn at the "T" intersection and a head-on between a turning vehicle and a vehicle stopped at the approach. There was one injury accident reported. The other three accidents occurred at the crossing. The jog at the crossing was a contibuting factor in all three accidents.

General improvement recommendations for this site include:

- Relocate crossing signals and upgrade by adding motion sensors and speed predictors.
- Realignment and surface improvement of the railroad crossing.
- Improved signing and delineation at the intersection of 2nd Avenue W.N. and 4th Street W.N.

6. 4th Avenue East Railroad Crossing: One accident was reported at the intersection of 4th Avenue East and the railroad tracks. It involved a car/train collision that was a result of icy road conditions. The accident resulted in one injury.

The recommended improvements at this site include:

- Improved approach signing
- Surface improvements at the crossing

7. Tamarack Lane and Rocky Lane: Both of these accidents were sideswipe collisions and appear to be the result of excessive speed and driver error. No improvements are recommended at this location.

8. Tamarack Lane and 4th Avenue W.N.: Two accidents occurred at this location during the four year period. One was an angle collision between approaching vehicles on the steep hill on the west leg of the intersection. The other was a single car accident involving excessive speed. The steep grade on the west leg of the intersection contributed to both accidents. One accident involved an injury.

A survey was made of this intersection to determine if improvements could be made to the west approach grade. At the time of the survey, it was observed that southbound vehicles on 4th Avenue W.N. are ignoring the new "yield" sign on the north approach.

General improvements recommended for this location are:

- Replace the "yield" sign on the north approach with a "stop" sign.
- Reconstruct the west approach to reduce grade from 12 percent to a maximum of 8.8 percent.

9. Tamarack Lane and Meadow Lake Drive: Two accidents occurred at this location during the study period. Both were angle collisions in the intersection, resulting in injuries. There is already a "stop" sign on the north approach, however, the accident report from a 1984 accident indicates there was high grass on the northeast corner of the

intersection. It is recommended that a sight triangle be maintained on the north approach.

10. Tamarack Lane and Woodland Road: Both accidents at this location involved single vehicles losing control, while turning from Tamarack Lane into Woodland Road. Both were a result of excessive speed during icy and snowpacked road conditions. No improvements are recommended at this location.

B. Emergency Access

A primary consideration in planning for access to the area north of the tracks is emergency vehicle access. Ambulance and fire department responses north of the tracks were tabulated for the period from 1983 through September 1985. The response locations are shown by general area on Figure 2. Table 8 is a tabulation of ambulance and fire department responses north of the tracks.

Table 8
Ambulance and Fire Department Responses -- 1983-1985

Department	1983	1984	1985 (Jan-Sept)	Total
Ambulance	10	13	3	26
Fire department	8	10	8	26
Total	18	23	11	52

Table 8 shows that there are approximately two emergency calls per month to the area north of the tracks. Based on the estimated growth, emergency responses to the area north of the tracks would total 33 in 1990, 61 in the year 2000, and 85 with full development. It should be noted that each response requires the ambulance to make two crossings of the railroad tracks which doubles the chance of a delay occurring due to rail traffic.

In planning for alternative railroad crossings, the following factors must be considered with regard to emergency access:

- Response Time -- Access across the railroad should be located as near as possible to the center of the population to be served so that the average response time is as short as possible. Another way of shortening the response time in the case of a grade crossing, is to provide a smooth crossing surface so that emergency vehicles can maintain a high crossing speed. This also reduces the chance of further injuries to patients being transported.

- Delays -- the most desirable solution to eliminating delay time would be a grade separation at the tracks. The alternative is to locate a grade crossing where the minimum number (two) of tracks are required to be crossed, and outside of the area where switching activities block the access.

Figure 2 shows that 81 percent of the emergency responses were located in the areas west of 12th Avenue West or in areas served directly by 12th Avenue West.

IV. ALTERNATIVE CROSSING ANALYSIS

IV. ALTERNATIVE CROSSING ANALYSIS

A. Optimum Crossing Location

Based on the Columbia Falls 1984 Master Plan, and a scenario which assumed Meadow Lake Estates Subdivision fully developed, a travel desire line model was calibrated. The model was used to assign projected traffic to alternative crossings and to determine the optimum crossing location. The optimum crossing location represents a location that would most conveniently serve all traffic crossing the tracks.

The locations shown in Table 9 were determined to be the optimum crossing, based on the existing and projected travel model.

Table 9
Optimum Crossing Locations

Travel Model Input	Optimum Crossing Location
1985 vehicular traffic	Extension of 11th Avenue W.N.
1990 vehicular traffic	242 feet east of 12th Avenue West crossing
2000 vehicular traffic	224 feet east of 12th Avenue West crossing
Full development of Meadow Lake Estates Subdivision	620 feet west of 12th Avenue West crossing
1985 total student crossings	1,068 feet east of 12th Avenue West crossing
1990 total student crossings	304 feet east of 12th Avenue West crossing
2000 total student crossings	281 feet east of 12th Avenue West crossing
Full development student crossings	459 feet west of 12th Avenue West crossing

---

The pertinent findings from Table 9 are summarized below:

- The optimum location for vehicular trips shifts 375 feet to the west from 1985 to 2000.

- The optimum location is west of the 12th Avenue West crossing assuming total development of Meadow Lake Subdivision.

- Optimum locations for student crossings show similar shifts from east to west based on future development north of the tracks.

The calculated optimum crossing locations are only a part of the evaluation of a feasible crossing location. They serve to show existing and future trends in the traffic patterns. Other variables including connection to the existing street system, crossing grade, overpass versus underpass, and cost-benefit ratio, all need to be considered. Since a structure has a 30 to 50 year life, it should be located based on future development as well as existing traffic demands.

Eight sites were selected for analysis as possible crossing locations. Each site was surveyed to determine roadway alignment, grades, superelevations, and other physical characteristics. Surrounding topography was also surveyed showing sign and other traffic control device locations, fences, utility poles, trees, and other roadside objects.

The following sites were surveyed:

1. Extension of North Hilltop Road
2. Extension of Meadow Lake Drive
3. Extension of Rocky Lane
4. 12th Avenue West crossing
5. Extension of 4th Avenue West
6. 2nd Avenue West
7. Extension of Nucleus Avenue
8. 4th Avenue East
9. West approach of Tamarack Lane and 4th Avenue W.N.[1]

Site 4 was not included in the field survey but has the same topographic characteristics as Rocky Lane. The Rocky Lane survey has been used to make cost estimates for this site.

---

[1]This site was surveyed to determine the feasibility of reducing the grade.

The existing crossings at 2nd Avenue West and 4th Avenue East, and Tamarack Lane at 4th Avenue W.N., were surveyed to provide site plans for recommended improvements.

Figure 3 shows the location and possible connecting roads for the seven crossing alternatives.

Figures 4 through 9 show plans and profiles of the crossing sites that were surveyed.

B. Estimated Traffic Volumes

The travel model was used to estimate traffic volumes on each of the alternative crossings. These volumes are compared in Table 10.

Table 10
Estimated Traffic Volumes -- Alternative Crossings

Crossing	Site	1990 ADT	2000 ADT	Full Development ADT
Hilltop Road	1	1,870	3,630	5,520
Meadow Lake Drive	2	2,330	4,540	6,970
Rocky Lane	3	2,490	4,790	7,220
West Plum Creek	4	2,640	5,270	7,440
12th Avenue West	5	2,660	5,330	7,900
4th Avenue West	6	2,730	5,080	7,280
Nucleus Avenue	7	2,680	4,950	7,022

The following is a summary of some of the pertinent findings from Table 10:

FIGURE 3
Alternative Crossing Sites

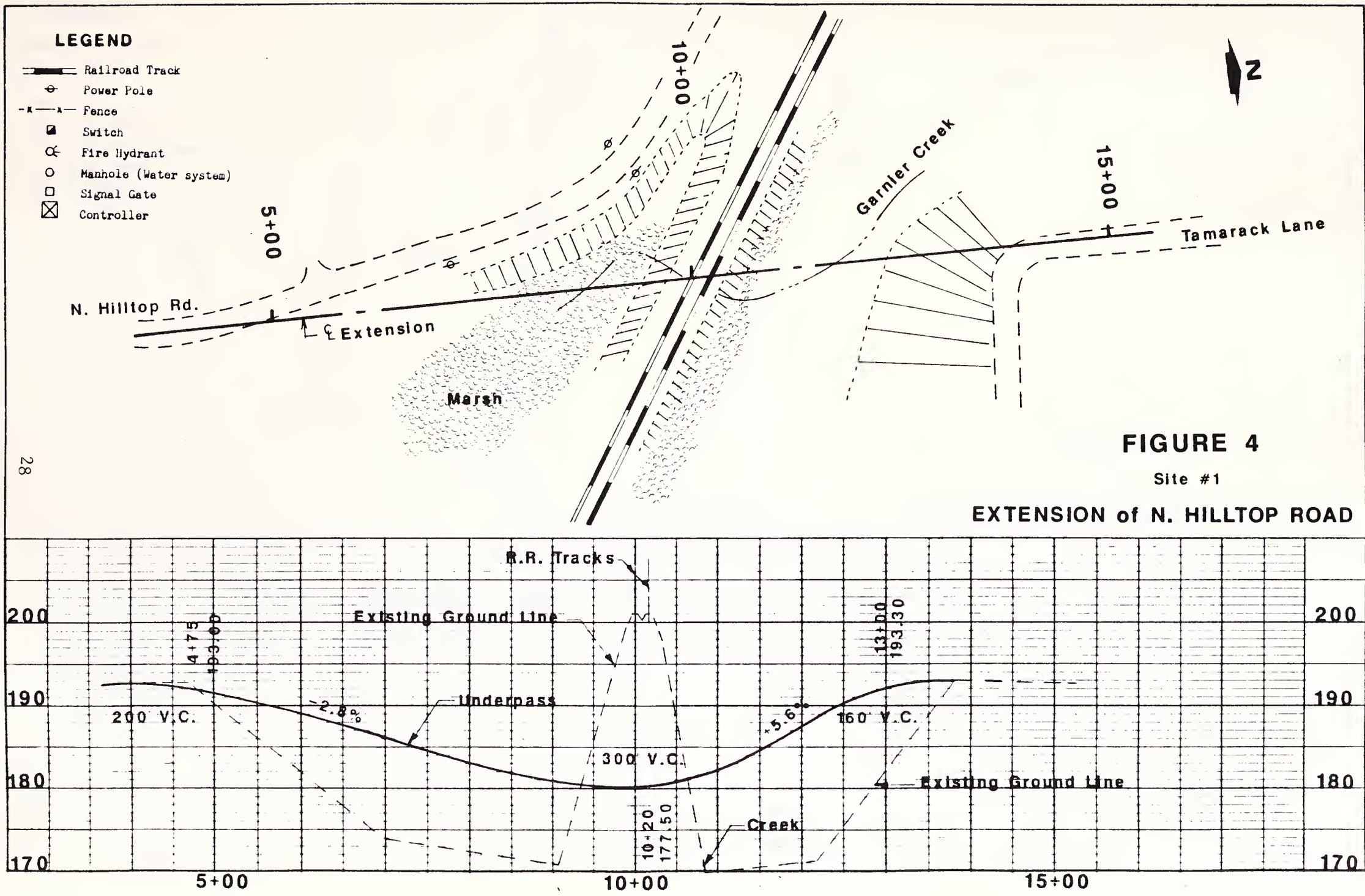


FIGURE 4

Site #1

EXTENSION of N. HILLTOP ROAD

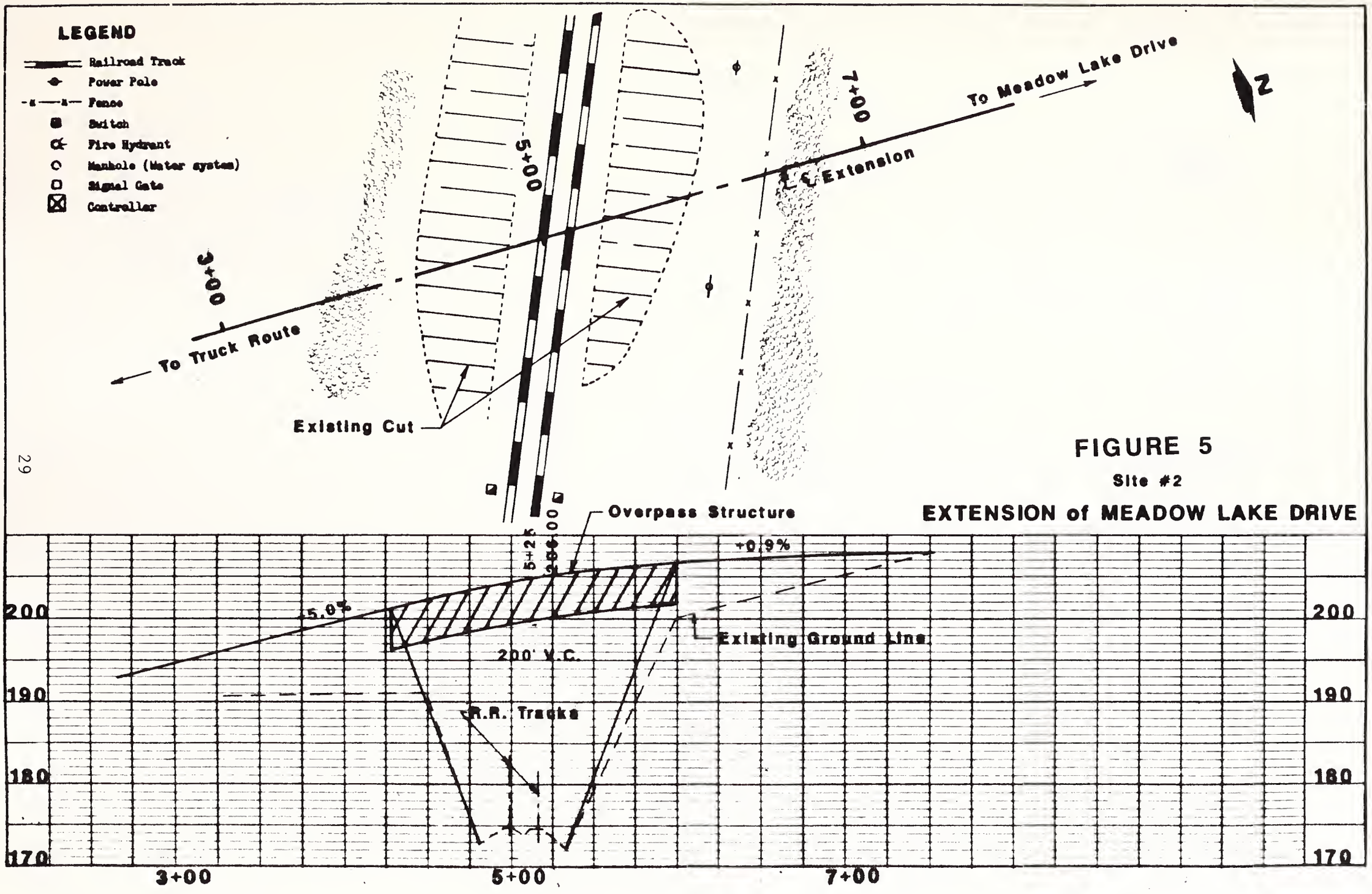


FIGURE 5

Site #2

EXTENSION of MEADOW LAKE DRIVE

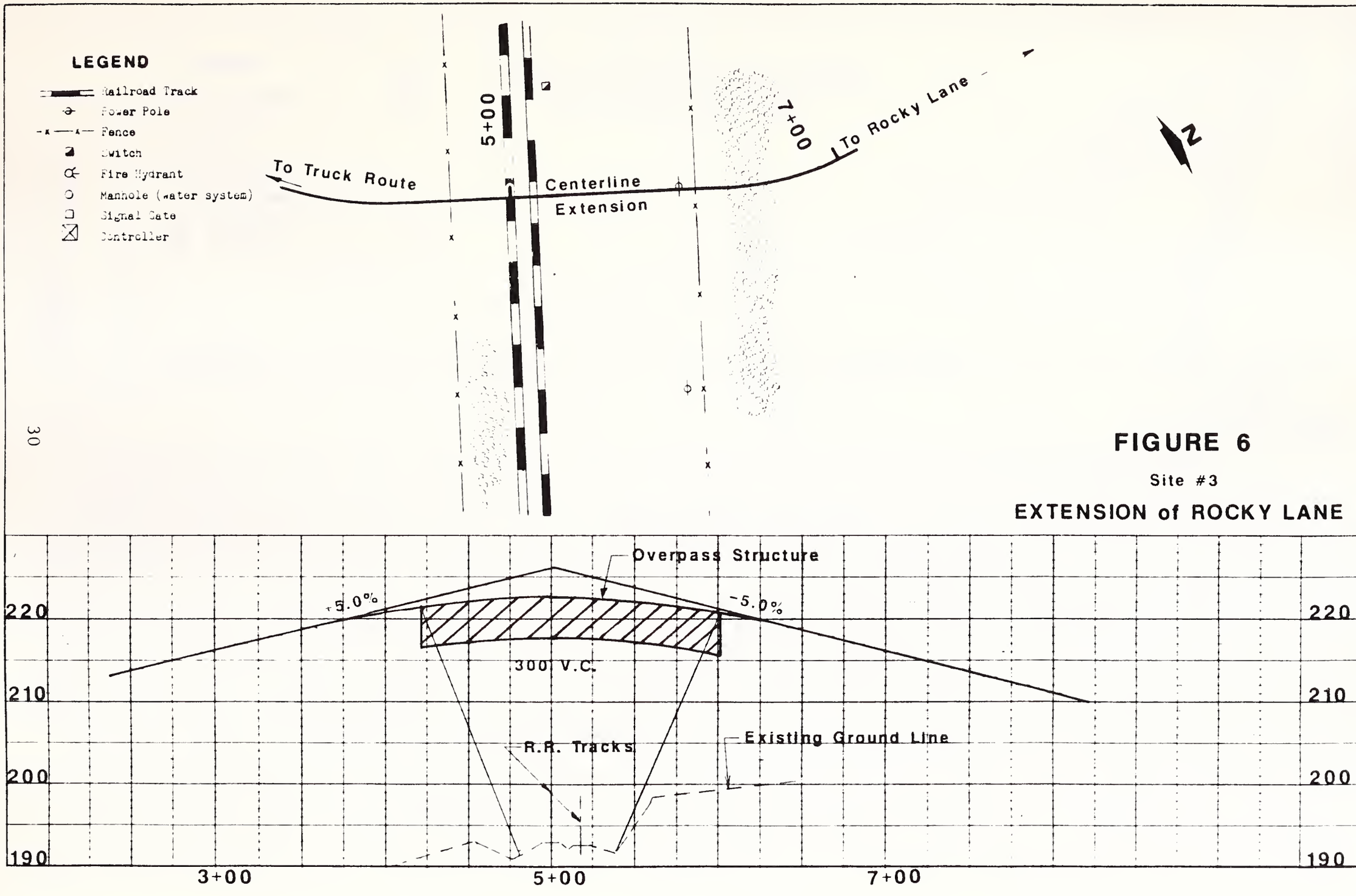


FIGURE 6

Site #3

EXTENSION of ROCKY LANE

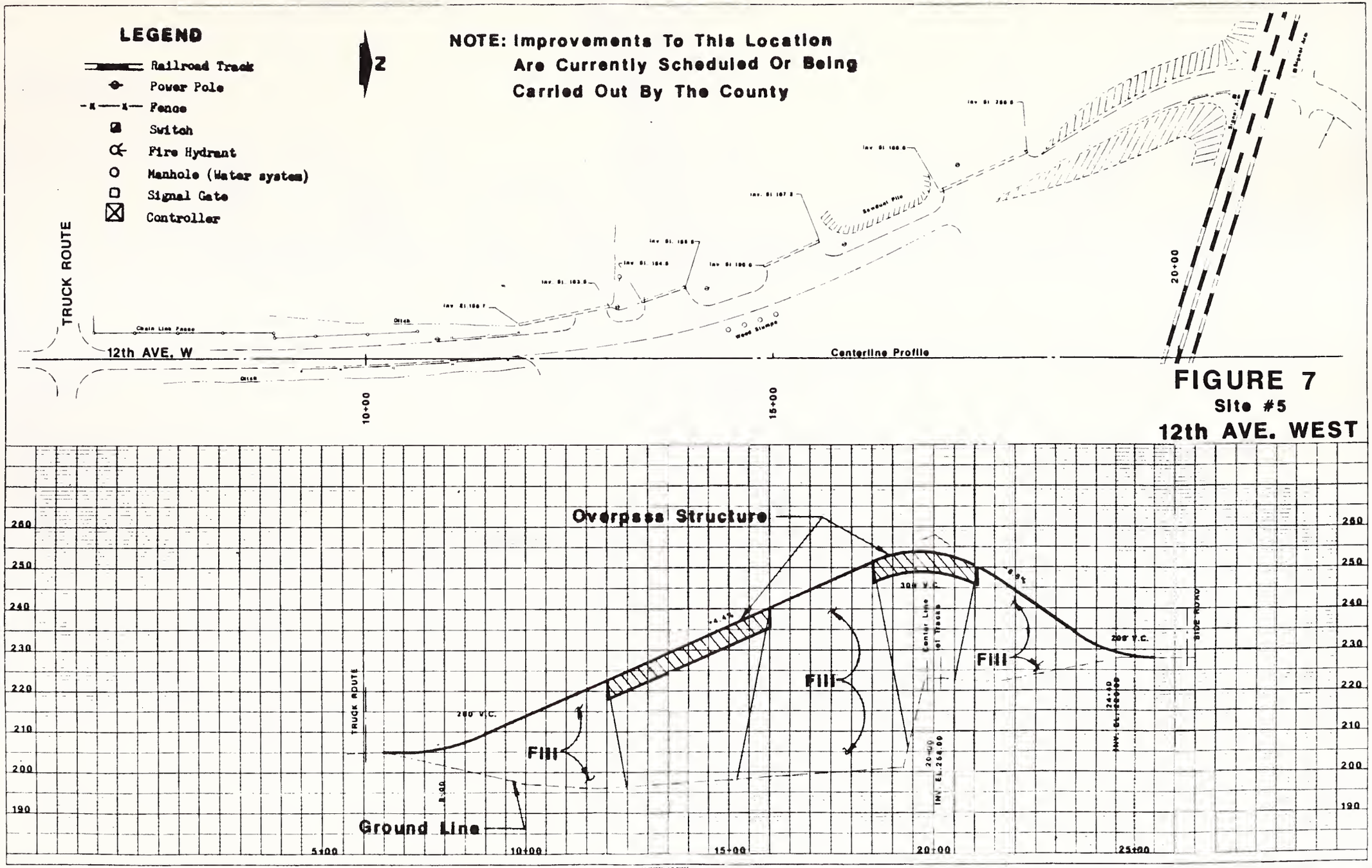
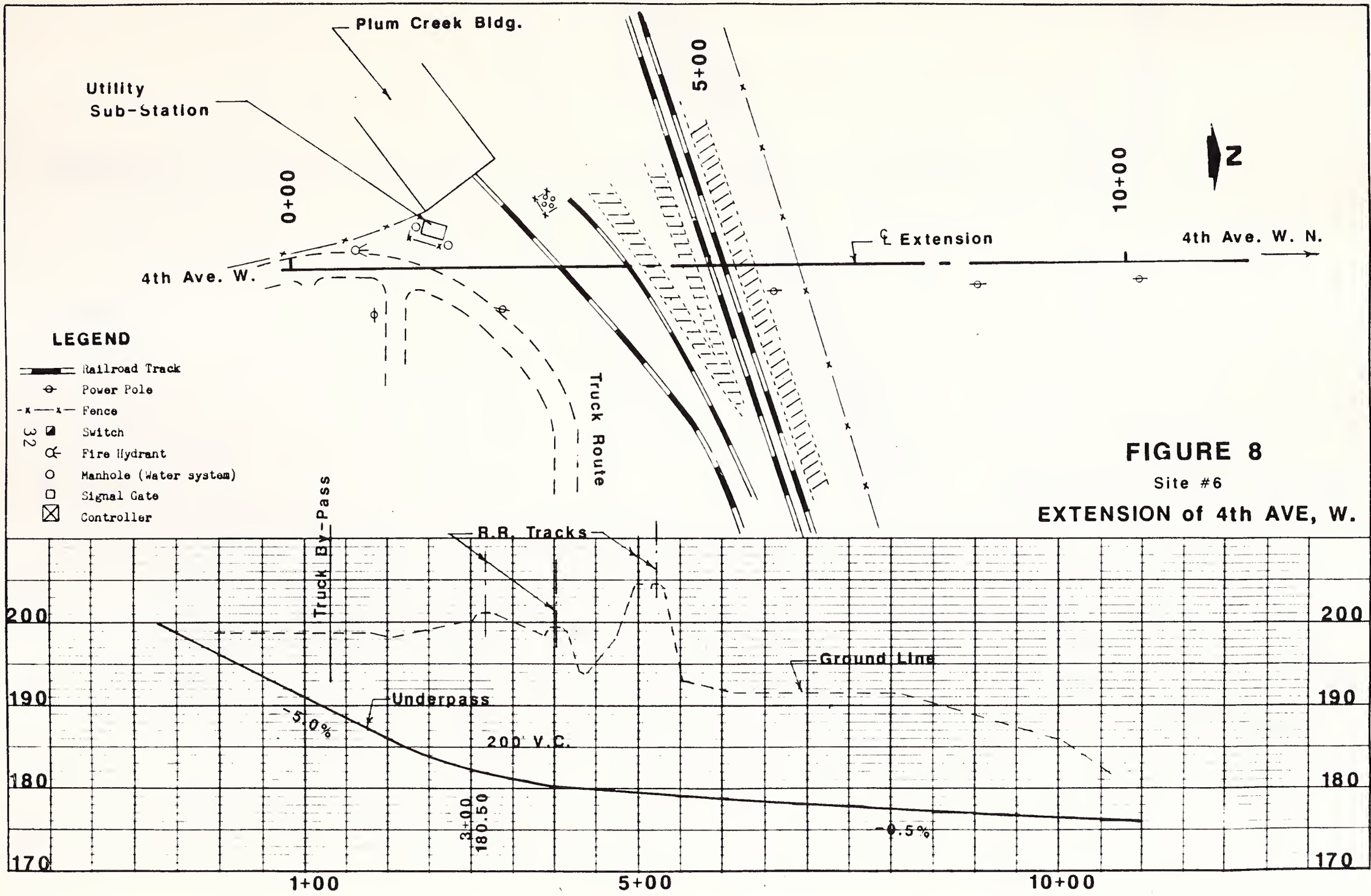
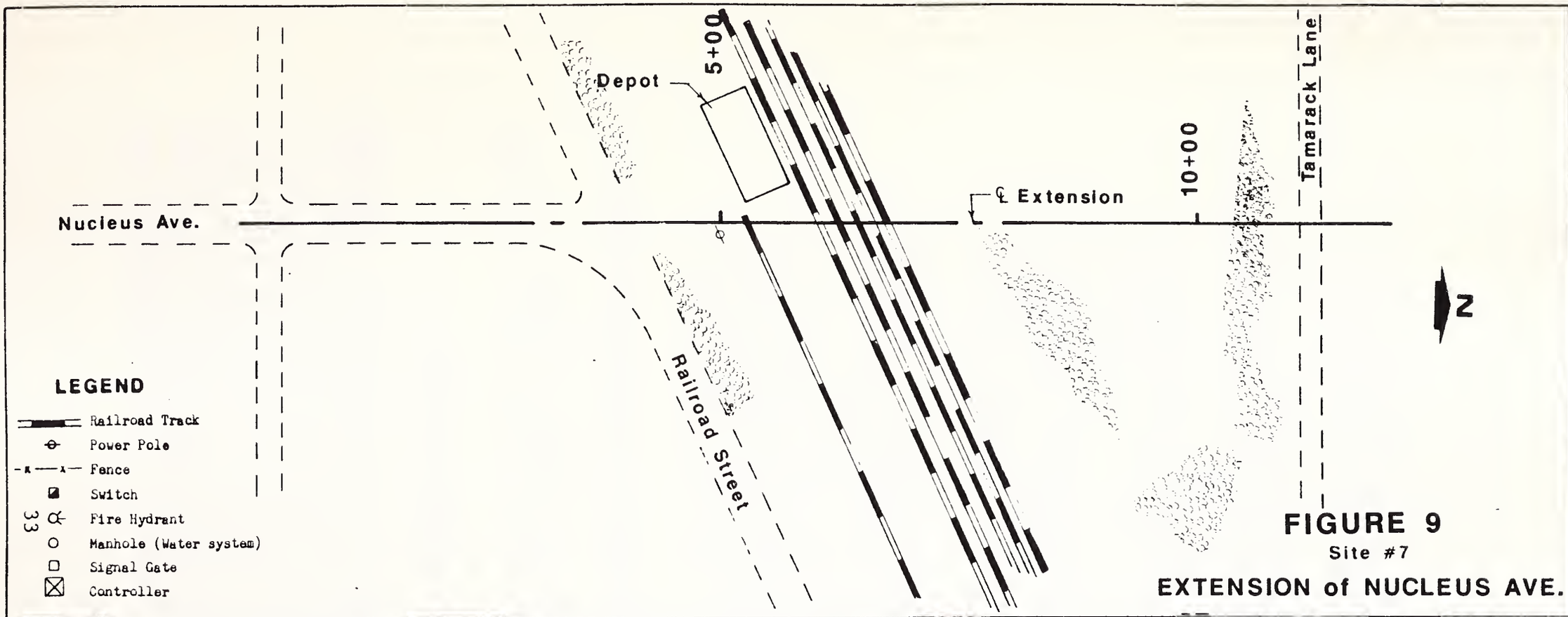


FIGURE 7
Site #5
12th AVE. WEST


Plum Creek Bldg.
Utility
Sub-Station
0+00
5+00
10+00
N
℄ Extension
4th Ave. W. N.
4th Ave. W.
Truck Route
LEGEND
Railroad Track
Power Pole
Fence
Switch
Fire Hydrant
Manhole (Water system)
Signal Gate
Controller
32
FIGURE 8
Site #6
EXTENSION of 4th AVE, W.
Truck By-Pass
R.R. Tracks
Ground Line
Underpass
-5.0%
200' V.C.
-0.5%
3+00
180.50
200
190
180
170
1+00
5+00
10+00

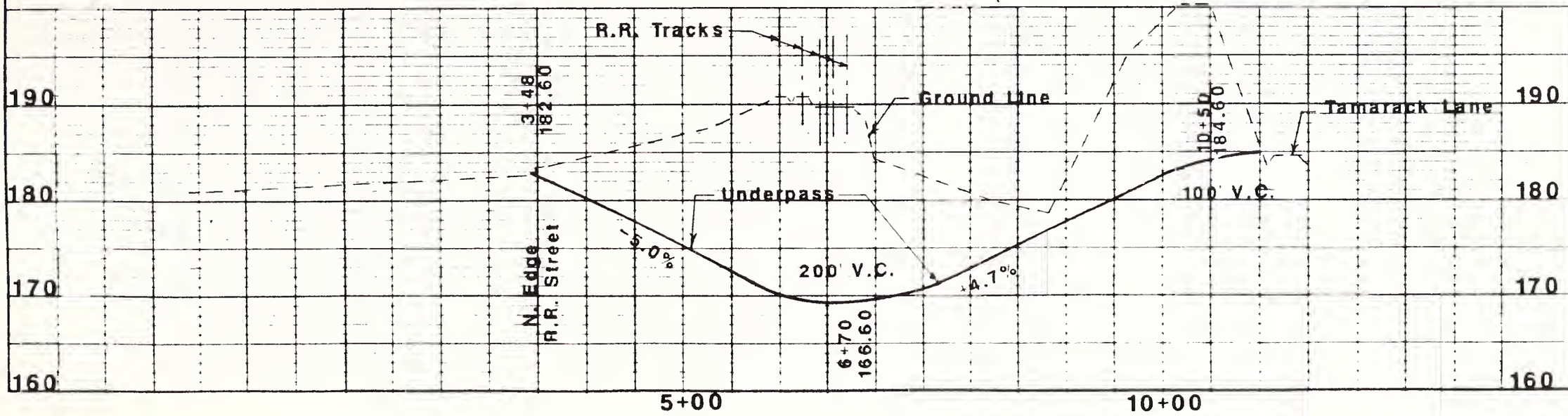


33

FIGURE 9

Site #7

EXTENSION of NUCLEUS AVE.



1. At 12th Avenue West and at the sites west of 12th Avenue West, projected traffic volumes vary proportionally with the distance from the optimum location.

2. The 12th Avenue West crossing would carry the most traffic of the seven alternatives, assuming a structure, which would provide free flow, could be constructed at this location.

3. Rocky Lane, Plum Creek West, 12th Avenue West, 4th Avenue West and Nucleus Avenue, have similar projected traffic volumes. Since these are estimates, the differences are not significant.

4. Hilltop Road carries the least traffic of the seven alternatives. It would divert traffic from the Tamarack-Halfmoon to U.S. 2 route but traffic destined to the Columbia Falls urban area would have a shorter route by using the 2nd Avenue West crossing.

5. The extension of Meadow Lake Lane or Rocky Lane would also divert traffic from the Tamarack-Halfmoon to U.S. 2 route. Traffic volumes increase on the Rocky Lane extension because of its location near to the optimum crossing location.

6. The extensions of 4th Avenue West and Nucleus Avenue carry similar traffic volumes for all time periods. These volumes are based on the assumption that the hill on the west approach of Tamarack Lane and 4th Avenue W.N. would be negotiable by traffic throughout the year.

C. General Evaluation of Alternative Crossings

The following is a general discussion of the advantages and disadvantages of the alternative crossing sites.

Site #1: Extension of Hilltop Road

Advantages: The topography at this location makes it possible to construct an underpass which would tie into Tamarack Lane on the north and North Hilltop Road on the south. The elevation difference from the creek bottom to the top of the track is sufficient to construct the bottom of the underpass at an elevation approximately 14 feet above the creek bottom. It would then be possible to drain the underpass into the creek, eliminating the need for pumping.

Approach grades would be well within acceptable limits (seven percent) with the north approach having a grade of three to four percent, and the south approach, four to five percent.

Since the location ties into the existing road system on both sides of the tracks, the need for extensive construction of connecting routes is eliminated. This connection is recommended in the Columbia Falls Master Plan.

The length of structure is minimized because the approaches will be on a fill section up to the toe of the existing railroad embankment, eliminating the need for long retaining walls.

Construction in this location would not significantly affect surrounding properties.

Disadvantages: This crossing carries the least traffic of the seven alternatives. It is estimated to carry 47 percent less traffic than the 12th Avenue West crossing in 1990, and 32 percent less traffic with full development.

Increased traffic volumes on North Hilltop Road will require improvements and the road would require realignment on the south approach. The intersection of Hilltop Road and U.S. 2 has poor sight distance to the west.

Although the creek may be used to eliminate the need for pump drainage of the underpass, there will be a need for obtaining a construction permit for the rechannelization and disturbance of the creek during construction and a permit for point discharging drainage from the underpass into the creek. This will involve approval or permits from the Department of Health and Environmental Sciences; Montana Department of Fish, Wildlife and Parks; and the U.S. Fish and Wildlife Service. Any construction at this location will involve coordination with the local Conservation District as required by the Streambed Act.

Approximately 400 feet of right-of-way (ROW) would be required between North Hilltop Road and Tamarack Lane.

Site #2: Extension of Meadow Lake Drive

Advantages: The topography at this site makes it possible to construct an overpass with a minimum length of structure (255 to 350 feet). The high bank on both sides of the track allows the approaches to the structure to be maintained at three percent or less grade. This crossing would have the least cost for structure than any of the other alternatives.

Disadvantages: This crossing would carry 17 percent less traffic than 12th Avenue West in 1990, and 13 percent less with full development. This is not a strong disadvantage.

The major disadvantage of this location is the need for construction of connecting roads on both sides of the crossing. On the north side there would be a need for ROW acquisition and construction of approximately 800 feet of roadway. On the south there would be a need for 300 feet of ROW across Plum Creek Lumber Company property to an existing county ROW. From this point, there are several alternatives:

1. West 1,360 feet along the existing county ROW to North Hilltop Road.

2. South 1,360 feet, then east 1,360 feet, then south 1,360 feet, along the existing county ROW to the west extension of the Truck Route. This route would intersect with the extension of the Truck Route just west of the existing county solid waste disposal area.

3. From the point 300 feet south of the crossing, south 1,360 feet along the existing county ROW, then south on the same alignment for 2,600 feet to U.S. Highway 2. This section would require ROW acquisition.

4. From the point 300 feet south of the crossing, then east on Plumb Creek Lumber Company property, parallel to the

Burlington Northern tracks to a point due north of the existing county ROW that forms the west boundary of the county solid waste disposal area, then south along that ROW to the extension of the Truck Route.

It may be possible to combine two of these options into a staged construction schedule.

The intersection at Tamarack Lane and Meadow Lake Drive would require that the south approach be skewed so that a four-legged intersection could be constructed.

Site #3: Extension of Rocky Lane

Advantages: This crossing is estimated to carry the fourth highest traffic volume of the seven locations. The 1990 volume is estimated to be 11 percent less than the 12th Avenue West crossing and nearly an equal volume as 4th Avenue West with full development. This difference is insignificant, considering that these are estimates.

Disadvantages: The topography at this site is relatively level, requiring long approach fills to maintain an acceptable grade. The total length of structure and fill would be approximately 1,000 feet, if a five percent approach grade is maintained.

This location would also require construction of connecting roads. On the north side there would be a need for ROW acquisition, and construction of 300 feet of road. On the south there would be a need for 1,260 feet of ROW to the existing county ROW. From this point, new road would be constructed on existing county ROW for 600 feet east and 1,360 feet south, to the extension of the Truck Route.

Site #4: Plum Creek West

Advantages: This crossing location has the highest loading of the six locations, after the year 1993.

The topography at the site would allow a grade crossing just to the east of the location most feasible for an overpass. This would allow for phased development of the crossing, with phase 1 being the construction of connecting roads and a grade crossing, and phase 2, the construction of a structure over the tracks. Traffic could be maintained on the grade crossing during construction of the structure. There are embankments on both sides of the track which would reduce the amount of fill for the approaches.

There are only two tracks to cross. The location is far enough west of the Plum Creek Lumber Company so that switching activities would have less interference with the grade crossing than at the 12th Avenue West crossing.

The location lines up with existing county ROW south of the tracks and is in line with a property boundary which is under only two ownerships on the north side of the tracks. The access road to the Plum Creek Dump could possibly be developed as an access to Vetville.

Disadvantages: There is a need for 1,450 feet of ROW north of the tracks and 1,000 feet of ROW south of the tracks.

The structure would be more costly than at the Meadow Lake Drive site.

There may be drainage and soil problems in constructing the south connecting road since the soils in this area are subject to frost heave and have limited load bearing capacity.

Site #5: 12th Avenue West

Advantages: This crossing is nearest to the optimum crossing location and has the highest traffic volume of the seven alternative locations. Development north of the tracks has centered around this location.

A crossing at this location provides direct access to the high school and elementary school located south of U.S. Highway 2.

There are three tracks to cross at this location, the main line tracks and a spur line into the Plum Creek Lumber Company, this is an advantage over the 4th Avenue West and Nucleus Avenue crossings which cross four and six tracks, respectively.

Disadvantages: This crossing would require two structures. One to span the BN tracks and the other to provide an equipment access in the mill area. A clear span from the tracks to the Truck Route would cost an additional $700,000. This is the most expensive crossing of the seven alternatives.

The fill section between structures would require approximately 170 feet of additional right-of-way width through the lumber company area. If a structure is built at this location, the north end of the crossing should be realigned. This would require additional ROW and acquisition of at least one residence.

The hill on the north approach should be reduced to provide better access in the winter.

Site #6: Extension of 4th Avenue West

Advantages: This crossing location has the third highest traffic loading of the seven sites. It also is a direct access for student pedestrian crossings to and from the school complex located on 4th Avenue West.

On the north side of the tracks, there is an existing county ROW that extends to 4th Street North providing a straight connection from Railroad Street to Tamarack Lane.

Disadvantages: The traffic loading on this crossing is contingent on traffic being able to negotiate the steep hill on the west approach of the intersection of Tamarack Lane and 4th Avenue W.N. This hill would require a reduction in grade or continuous maintenance during snowpacked or icy road conditions.

The topography on the north side of the tracks is such that an underpass could be constructed which would slope to the north so that drainage for approximately 150 feet of the underpass could be removed by surface drainage. The north approach to the underpass would be very complex and a thorough analysis has not been completed. However, preliminary analysis shows the following problems:

1. It may not be possible to surface drain the underpass to the north which would require pumping.

2. Railroad Street would be terminated at 3rd Avenue West, putting heavy traffic on this residential street.

3. The Truck Route would be discontinued and an alternative route to handle truck traffic to Superior Lumber Company would need to be designated.

4. 1st Street North would be terminated at 4th Avenue West with either a cul-de-sac or a loop connection to 2nd Street North.

Due to these problems, this site has been dropped from further consideration.

Site #7: Extension of Nucleus Avenue

Advantages: This crossing location has the fifth highest loading of the seven sites with full development. It provides direct access to the Central Business District and connects to a major arterial which has a direct connection to U.S. Highway 2.

The topography on the north side of the tracks allows a connection between 4th Street North and an underpass with a grade of approximately two percent.

Disadvantages: This crossing has the same disadvantage as Site #4 in that, to use the crossing, residents west of 4th Avenue W.N. must negotiate Tamarack Hill.

The underpass will require pumping for drainage, which is an on-going maintenance cost.

Preliminary analysis shows that it may be possible to maintain a connection at Railroad Street; however, sight distance will be limited at the intersection.

Table 11 is a general evaluation of the soils at each site and along the connecting routes. The soils data was taken from a 1960 soils survey by the U.S. Department of Agriculture. The publication is titled "Upper Flathead Valley Area Soils Survey."

Table 11
Soils Limitations for Community Roads

Location	Soil Limitations
Site #1: Hilltop Road	Severe limitation due to frost heave and unfavorable load-bearing capacity
Site #2: Meadow Lake Drive	Severe limitation due to frost heave and load bearing potential
Site #3: Rocky Lane	Severe limitation due to frost heave and load bearing potential
Site #4: Plum Creek West	Moderate frost heave potential
Site #5: 12th Avenue West	Moderate frost heave potential
Site #6: 4th Avenue West	Slight limitations
Site #7: Nucleus Avenue	Slight limitations

It should be noted that the railroad and many roads have been constructed on soils typical of those at Sites 1, 2, and 3; however, construction at these sites would be more expensive due to high ground water tables and poor load bearing capacity.

D. Cost Estimates

Average bid prices from the Montana Department of Highways for January 1985 through June 1985, were used to estimate the construction cost of structure and connecting roadway at each alternative crossing site.

Right-of-way costs were estimated at $10,890 per acre or 25¢ per square foot.

The costs are based on a 36-foot structure and 32-foot roadways within a 60-foot ROW.

Four optinal connections were estimated for Meadow Lake Drive. No cost estimate was made for 4th Avenue West. This site was dropped because the Truck Route cannot be maintained with the underpass and the residential area on the south side of the tracks would be severely disrupted.

Table 12 shows estimated costs for each alternative crossing.

Table 12
Cost Estimates: 1985 Dollars

Location	Site No.	ROW	Roadway	Structure	Total
Hilltop Road	1	$ 6,300	$ 38,600	$ 932,100	$ 977,000
Meadow Lake Drive	2				
West to Hilltop		17,250	52,900	538,500	608,650
East along B.N.		49,500	151,800	538,500	739,800
South to U.S. 2		58,050	178,000	538,500	774,570
South to Truck Rt.		17,250	52,900	538,500	608,650
Rocky Lane	3	6,600*	208,000	611,900	874,500
Plum Creek West	4	36,800	98,000	684,100	818,900

*Does not include Plum Creek ROW.

Table 12
Cost Estimates: 1985 Dollars (Continued)

Location	Site No.	ROW	Roadway	Structure	Total
12th Avenue West	5	118,400	57,000	1,830,500	2,005,900
4th Avenue West	6		Dropped		
Nucleus Avenue	7	15,000	46,000	1,748,700	1,809,700

The cost estimates in Table 12 are based on preliminary surveys and may change when detailed engineering studies are made. The costs show the relative difference for each site.

E. Benefit/Cost Analysis

A comparison of user benefit to the cost of an improvement shows the number of dollars returned for each dollar invested.

For this analysis, the following user costs will be estimated:

- User delay at railroad crossings and Plum Creek Lumber Company
- User travel costs due to crossing location
- Accident costs

1. User Delay at Railroad Crossings and Plum Creek

Manual traffic counts were made at the existing railroad crossings and at the heavy equipment crossing in the Plum Creek Lumber Company area.

User delay costs are based on an average vehicle occupancy of 1.5 persons and an hourly time cost of $4.00 per hour. Equipment delay costs are based on $35.00 per hour. Table 13 shows estimated user delay costs.

Table 13
User Delay Costs: 1985 - Full Development

Location	User Delay (Hours/Day)	Annual Cost 1985	1990	2000	Full Development
12th Ave. W.	0.5	$ 1,095	$ 1,570	$ 2,885	$ 4,050
2nd Ave. W.	6.7	14,670	21,040	38,640	54,275
4th Ave. E.	9.5	20,805	29,840	54,810	76,985
Plum Creek Yard	4.5	40,950	58,730	107,870	151,510
Total	21.2	$77,520	$111,180	$204,205	$286,460

Table 13 shows that 12th Avenue West had the least delay time amounting to one-half hour per day. The 4th Avenue East crossing had a delay time of 9.5 hours per day. This crossing was closed for 46 minutes during switching in the yard. During this period, most vehicles turned around and used another crossing, a few went around the gates.

Table 14 shows estimated user savings based on reduced delay time, for each alternative location.

Table 14
User Delay Cost Reduction: 1985 - Full Development

Location	Annual Cost Reduction 1985	1990	2000	Full Development
Site #1: Hilltop Rd.	$42,040	$60,300	$110,775	$155,560
Site #2: Meadow Lake	44,680	64,085	117,715	169,670
Site #3: Rocky Lane	46,440	66,615	122,345	172,930
Site #4: W. Plum Cr.	46,880	67,245	123,505	174,560
Site #5: 12th Ave. W.	46,880	67,245	123,505	174,560

Table 14
User Delay Cost Reduction: 1985 - Full Development
(Continued)

Location	Annual Cost Reduction 1985	1990	2000	Full Development
Site #6: 4th Ave. W.	46,880	67,245	123,505	174,560
Site #7: Nucleus Ave.	56,710	81,340	149,395	209,840

Table 14 shows that the Nucleus Avenue crossing would have the greatest reduction in user delay time of any alternative. If the Nucleus Avenue crossing were constructed, 2nd Avenue West would be closed, resulting in a 100 percent reduction of the delay time at that crossing.

The crossings to the west have less impact on the traffic at the 2nd Avenue West crossing and show a decreasing reduction in delay time.

All alternatives would eliminate the delay times at 12th Avenue West and at the Plum Creek Lumber Company crossing.

2. User Travel Distance Due to Crossing Location

The proximity to the optimum crossing location can be used to estimate the relative user costs for each alternative. Table 15 shows the distance in miles of each alternative from the optimum crossing location.

Table 15
Distance From Optimum Location

Location	Site No.	1990	2000	Full Development
Hilltop Road	1	0.98	0.98	0.84
Meadow Lake Drive	2	0.75	0.75	0.58
Rocky Lane	3	0.61	0.60	0.44

Table 15
Distance from Optimum Location
(Continued)

Location	Site No.	1990	2000	Full Development
Plum Creek West	4	0.56	0.55	0.39
12th Avenue West	5	0.05	0.04	0.12
4th Avenue West	6	0.50	0.51	0.71
Nucleus Avenue	7	0.76	0.77	0.97

Table 15 shows that 12th Avenue West is the nearest to the optimum crossing location. As development takes place, the locations west of 12th Avenue West become more desirable and 12th Avenue West, 4th Avenue West, and Nucleus Avenue require longer average travel distances.

3. Accident Costs

The Montana Department of Highways uses estimates of the reduction of accidents to determine the benefit/cost ratio for safety engineering improvements.

Table 16 shows user savings due to accident reduction, for each alternative.

Table 16
Accident Reduction Benefit

Location	Site	Accident Reduction Benefit (Full Development)
Hilltop Road	1	$47,200
Meadow Lake Drive	2	59,810
Rocky Lane	3	61,610
Plum Creek West	4	63,770
12th Avenue West	5	63,770
4th Avenue West	6	Dropped
Nucleus Avenue	7	60,170

---

4. Summary

Table 17 summarizes the total benefit/cost ratios for each alternative based on user savings from delay time and accident reduction.

Table 17
Annual Benefit/Cost Ratios

Location	Site	Full Development User Benefit	Cost	Full Development Benefit/Cost
Hilltop Road	1	$202,760	$ 97,700	2.08
Meadow Lake Drive	2	229,480	60,865	3.77 - 2.96
Rocky Lane	3	234,540	87,450	2.68
Plum Creek West	4	238,330	81,890	2.91
12th Avenue West	5	238,330	200,590	1.19
4th Avenue West	6		Dropped	
Nucleus Avenue	7	270,010	180,970	1.49

Table 17 shows that Meadow Lake Drive and Plum Creek West have the highest return for dollar of improvement. The variation in benefit/cost for Meadow Lake Drive is due to the variation in connecting roads.

F. Recommended Alternative

Based on the foregoing analysis, it is recommended that Site #3, the Rocky Lane location, be selected as the location for a future overpass.

The following is a summary of the pertinent findings on which this recommendation is based.

- The connecting roadway can be constructed so that Plum Creek expansion to the west will not be cut off.

- This location had the third lowest cost of the seven alternatives.

- The crossing carried the third highest traffic volumes.

- The location is the third nearest to the optimum crossing location and becomes increasingly closer as development takes place.

- Only two tracks are crossed and the site is out of the main switching area.

- By looping the south connecting road to the west, the location aligns with the existing county ROW south of the tracks.

- Right-of-way required south of the tracks is on land owned by Plum Creek Lumber Company.

- A direct connection to Vetville is possible.

- Topography will allow for staged construction of a grade crossing with future construction of a structure to the west so that traffic can be maintained during construction.

- The site has the highest benefit/cost ratio of the seven locations.

- A direct connection to U.S. Highway 2 is feasible.

- The site presents the best opportunity for cooperative development involving government and private enterprise. For example, ROW trade-off for property access north of the site, and ROW and construction trade-off in exchange for 12th Avenue West ROW on property south of the site.

The recommended alternative would have the following design characteristics:

- Right-of-way -- 60 foot minimum

- Roadway -- 32-foot width, two 12-foot travel lanes with 4-foot shoulders

- Structure -- 36-foot width, two 12-foot travel lanes with 5-foot sidewalks

V. RECOMMENDED IMPROVEMENT PLAN

V. RECOMMENDED IMPROVEMENT PLAN

The recommended improvement plan consists of a combination of short range, transportation management improvements aimed at improving the operation of the existing street network, and the staged construction of major, long range improvements which will meet future traffic needs.

The short range improvements can be carried out within the next year or two. The long range improvements will require programming of local, state, federal and private funds and a longer implementation time.

A. Short Range Improvement Plans

Project #1: West Approach of the Intersection of Tamarack Lane and 4th Avenue W.N.

Description: Reduce the grade on the west approach of Tamarack Lane and 4th Avenue W.N. by cutting the hill back. Replace the "Yield" sign on the north leg of the intersection with R1-1, 30" X 30" "Stop" sign. The improvement plan is shown on Figure 10.

Justification: The existing grade at one point on the hill exceeds 12 percent. During icy winter conditions this hill cuts off access to the east. A "Yield" sign was evidently placed on the north leg to allow traffic going up or down the hill to proceed without stopping. During the survey it was observed that southbound traffic is ignoring this sign. A more positive control is needed.

Cost: $17,500

Project #2: 2nd Avenue West Railroad Crossing

Description: Realign and reconstruct the 2nd Avenue West railroad crossing to provide a direct connection to 2nd Avenue West, south of the

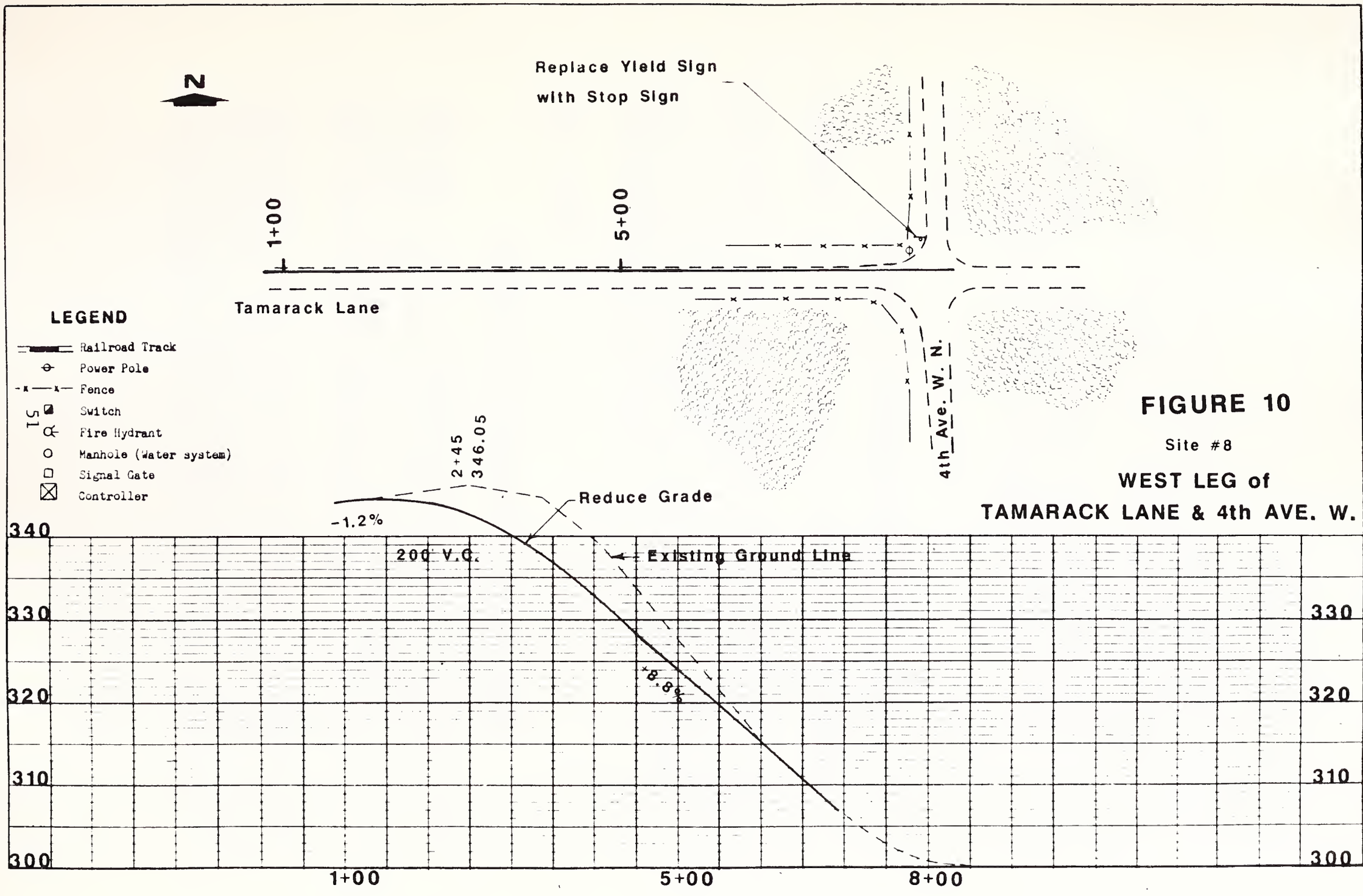


FIGURE 10

Site #8

WEST LEG of

TAMARACK LANE & 4th AVE. W.

tracks and an improved crossing surface. When the crossing gates are relocated, add motion sensors and speed predictors to reduce vehicle delay time. The improvement plan in shown on Figure 11.

Justification: Accidents occurring at this location indicate that the jog on the north approach is a contributing factor. Uncontrolled access on the south approach is a safety hazard.

Cost: $29,000

Project #3: 4th Avenue East Railroad Crossing

Description: Improve approaches and surface of railroad crossing.

Justification: Heavy truck traffic at this crossing has made the surface so rough that there is danger of passenger vehicles becoming stuck on the tracks. Realignment of the north approach would provide better visibility when coming into the crossing. The recommended improvements are shown on Figure 12.

Cost: $4,000

Project #4: 12th Avenue West Railroad Crossing

Description: Improve drainage and roadway surface on 12th Avenue West in the Plum Creek Lumber Company area. Clear foilage and roadside obstructions along 12th Avenue W.N., north of the tracks. Figure 6 shows culvert elevations and the general layout of this section.

Justification: Heavy equipment traffic across 12th Avenue West in the Plum Creek Lumber Company area, along with silt and mill debris build-up in the culverts, has caused the roadway to break up. Brush and trees on the north approach to the tracks obstructs the line of sight to the

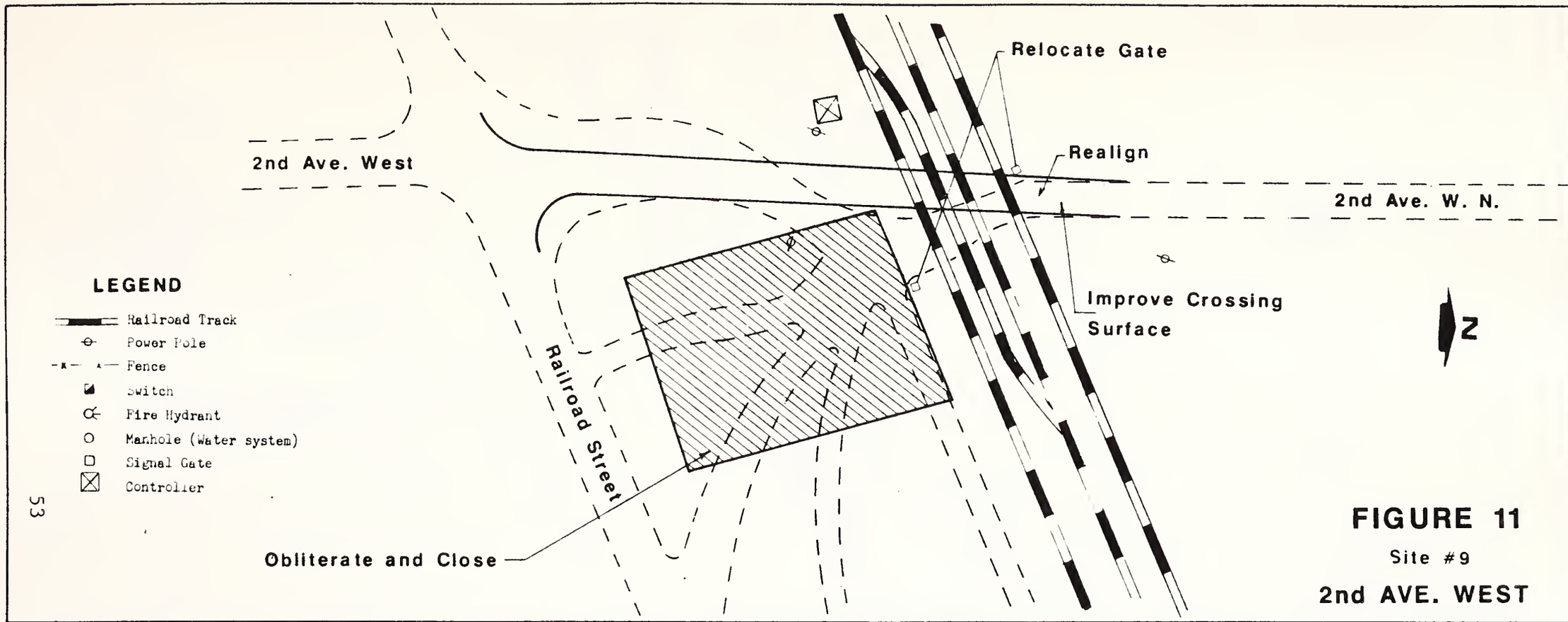


FIGURE 11

Site #9

2nd AVE. WEST

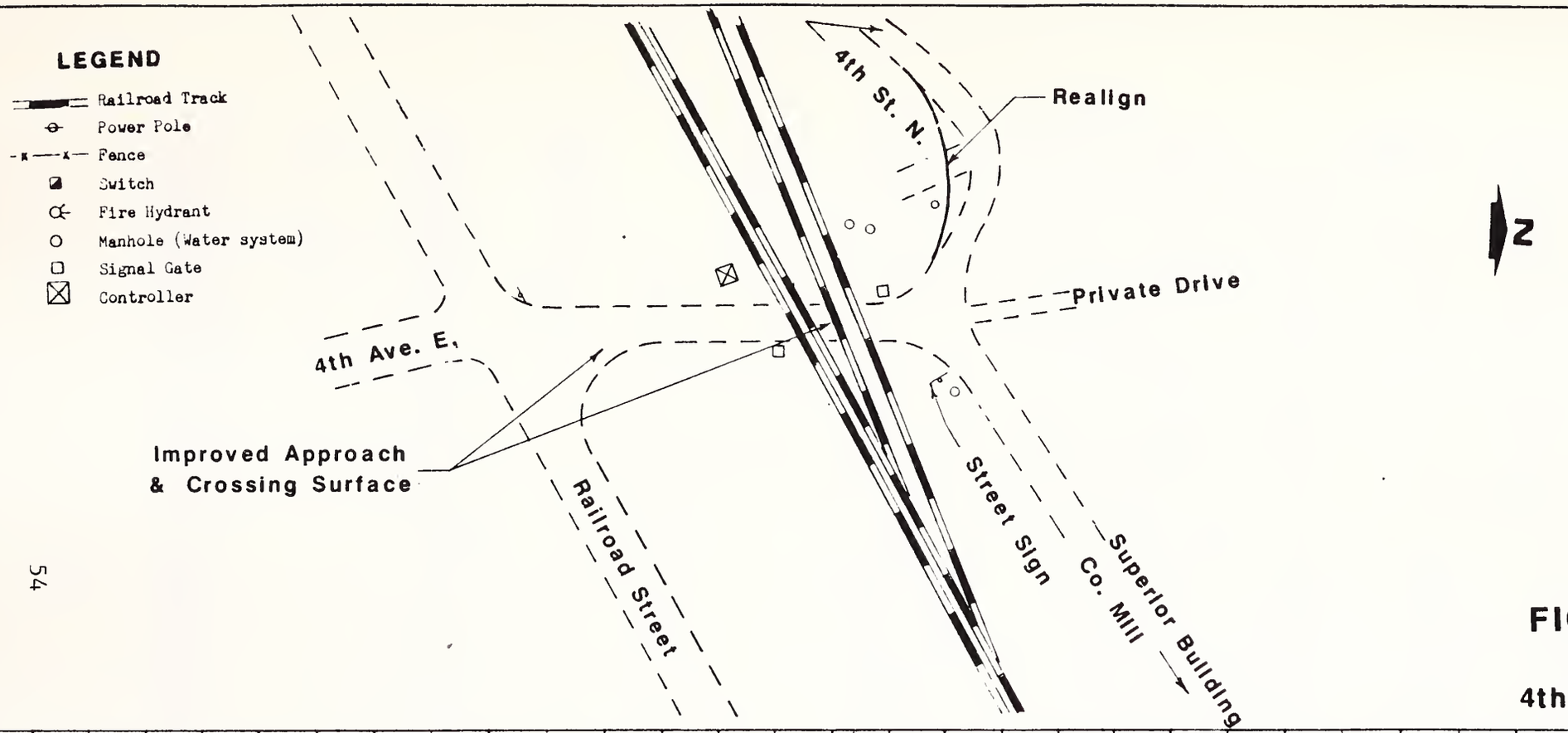


FIGURE 12

Site #10

4th AVE. EAST

crossing and covers the approach warning sign. This route will continue in use until an alternative route is developed. Improvements should be made to the existing roadway.

Cost: Improvements were being made during this study. No cost estimate was made.

Project #5: Intersection of 4th Avenue W.N. AND 4th Street North

Description: A countywide study of high accident locations, conducted in 1981 recommended several minor improvements at this location. These included, striping, signing, delineation, and widening. The improvements recommended in that report should be carried out. Figure 13 shows the recommended improvements.

Justification: This site was identified as a high accident location in the 1980 study. It is an important link between areas north and west of 4th Avenue W.N., and the 2nd Avenue West railroad crossing.

Cost: $2,352 (1981 study)

Project #6: Intersection of Truck Route and Mills Drive

Description: Install a W2-1, 30" X 30", crossroad sign[2] on the south and east approaches.

Justification: Accident history at this location indicates vehicles are approaching this intersection at excessive speeds.

Cost: $360

---

[2]Refer to Manual on Uniform Traffic Control Devices, U.S. Department of Transportation, Federal High Administration, 1978.

RECOMMENDED IMPROVEMENTS

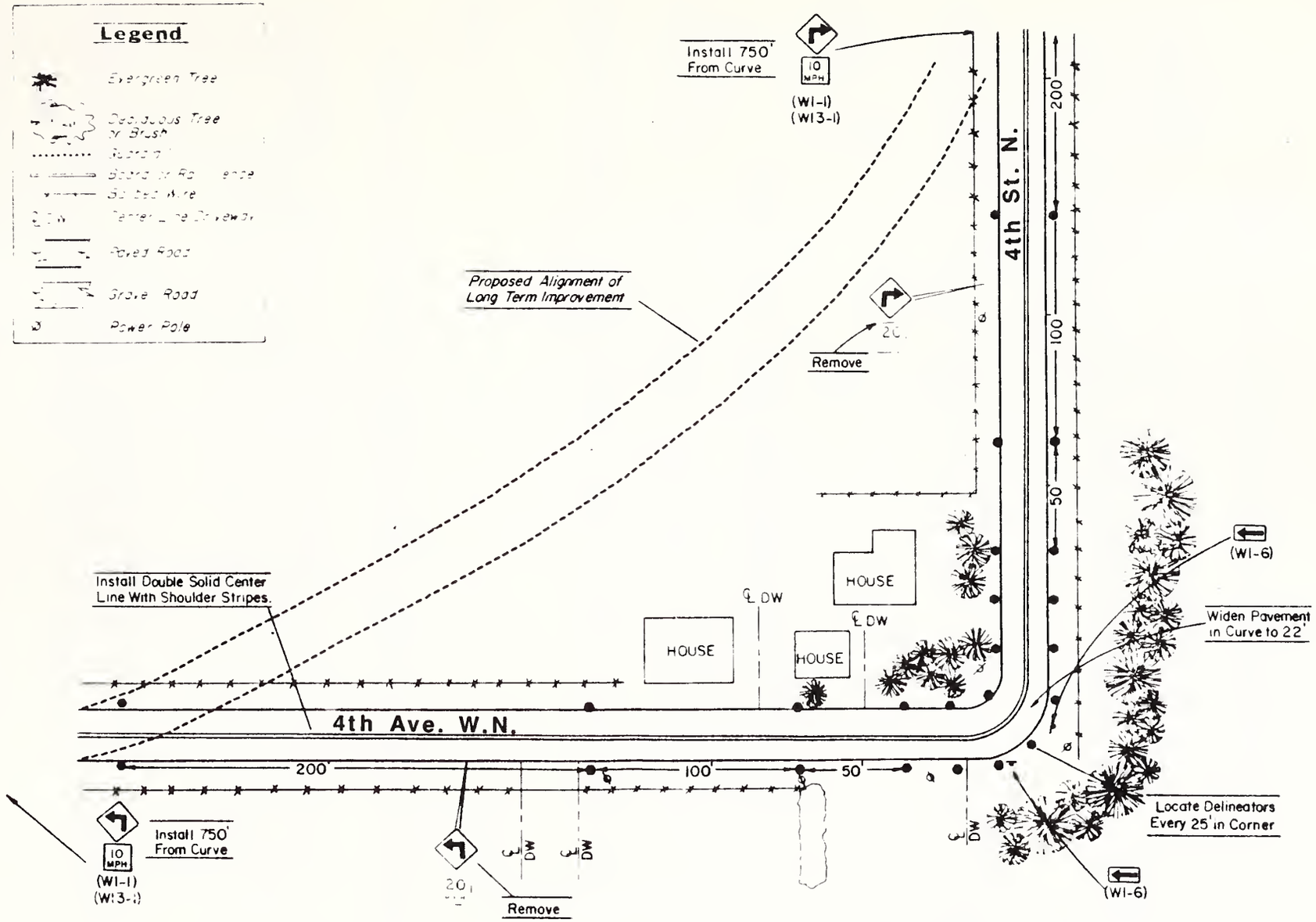


FIGURE 13

4th Ave. W.N. and 4th St. N

Project #7: 12th Avenue W.N. and Tamarack Lane

Description: Replace a "yield" sign with a 30" X 30", R1-1 "stop" sign on the south approach. Clear roadside obstructions and improve sight distance on the south approach. Install a W1-7, 48" X 24," large arrow sign[3] as shown in Figure 14.

Justification: This location has had six accidents during the four year period from 1981 through 1984.

Cost: $500

Project #8: Tamarack Lane and Meadow Lake Drive

Description: Maintain a sight triangle on the north approach.

Justification: Accident report indicating sight obstruction by high grass on the northeast corner.

Cost: $200

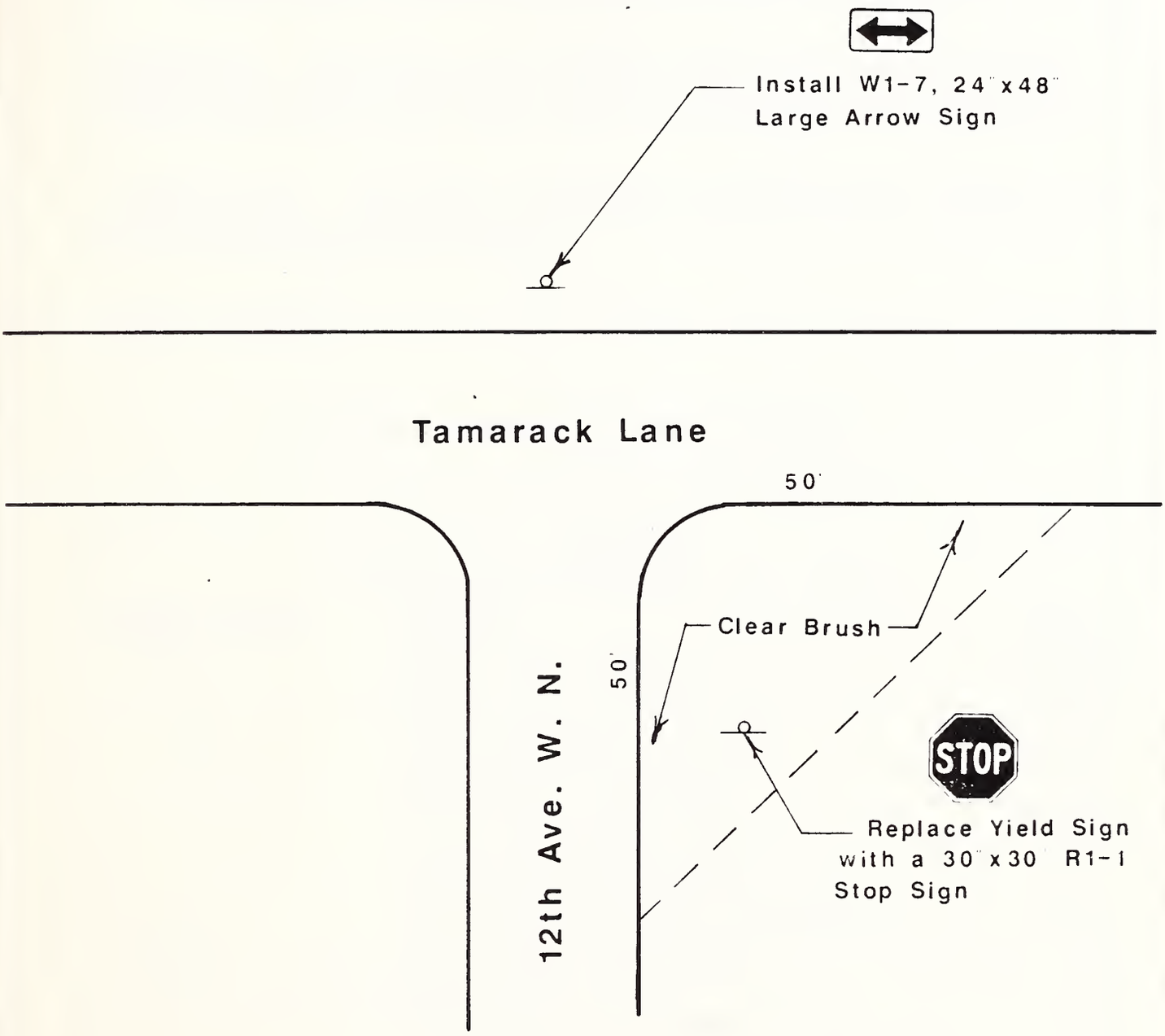
Project #9: Load/Unload Area at Junior High and Elementary Schools

Description: No specific design is recommended for this project. It requires coordination with the school activities and major entrance areas. A drive through, load/unload area, on the school property should be provided.

Justification: The existing load/unload traffic pattern is random, causing children to cross between stopped vehicles. A controlled area should be provided.

---

[3]Refer to Manual on Uniform Traffic Control Devices, U.S. Department of Transportation, Federal Highway Administration, 1978.



Typical Layout - Not to Scale

FIGURE 14

12th Ave. W. N. and Tamarack Lane

Cost: $5,000

Project #10: Truck Route from Mills Drive to 6th Avenue West

Description: Widen the south shoulder of the Truck Route from Mills Drive to 6th Avenue West and stripe for a pedestrian and bicycle lane.

Justification: Completes a pedestrian and bicycle route from Plum Creek West crossing to school complex.

Cost: $14,800

Table 18 summarizes the short range improvements:

Table 18
Short Range Improvements Cost Summary

Project Number	Location	Cost
1	Tamarack Lane & 4th Avenue W.N.	$17,500
2	2nd Avenue West & railroad	29,000
3	4th Avenue E. & railroad	4,000
4	12th Avenue West & railroad	NA
5	4th Avenue W.N. & 4th Street North	2,352
6	Truck Route & Mills Drive	360
7	12th Avenue W.N. & Tamarack Lane	500
8	Tamarack Lane and Meadow Lake Drive	200
9	Junior high & elementary schools	5,000
10	Pedestrian/bikeway	14,800
	Total	$73,712

B. Long Range Improvements

Project #1: Rocky Lane Connecting Roadway

Description: Acquire right-of-way and construct a roadway from Rocky Lane to the Rocky Lane railroad crossing and from the crossing, south to U.S. Highway 2.

Justification: This is stage 1 of relocating the 12th Avenue West railroad crossing.

Cost: $208,000

Project #2: Construct Plum Creek West Grade Crossing

Description: Relocate crossing gates from 12th Avenue West to the Rocky Lane site and construct a grade crossing. Close the 12th Avenue West crossing.

Justification: This is stage 2 of developing the Rocky Lane crossing.

Cost: $50,000

Project #3: Improve Truck Route

Description: Improve the Truck Route from the intersection of the Rocky Lane connecting roadway to Mills Drive.

Justification: Complete road construction of south connecting roadway to Plum Creek West railroad crossing.

Cost: $56,000

Project #4: Roadway West from Vetville to Rocky Lane

Description: Construct a roadway connecting Vetville to the Rocky Lane crossing.

Justification: This route will provide vehicular, pedestrian, and bicycle access to the Rocky Lane railroad crossing.

Cost: $132,000

Project #5: Roadway East from Vetville to 2nd Avenue West

Description: Construct a roadway connecting Vetville with 2nd Avenue West.

Justification: This route will provide vehicular, pedestrian, and bicycle traffic access to the 2nd Avenue West crossing.

Cost: $75,000

Project #6: Install Chain Link Fence -- Rocky Lane Crossing to 2nd Avenue West

Description: Install a six foot high, chain link fence on the north side of the Burlington Northern tracks, from the Plum Creek West railroad crossing to the 2nd Avenue West railroad crossing.

Justification: This fence will act as a pedestrian barrier, preventing pedestrian traffic from cutting through the Plum Creek Lumber Company mill operation.

Cost: $73,500

Project #7: Rocky Lane Railroad Crossing

Description: Construct an overpass to the east of the Rocky Lane grade crossing. Realign the approaches and close the grade crossing.

Justification:

Cost: $611,900

Table 19 summarizes the long range improvements:

Table 19
Long Range Improvements Cost Summary

Project Number	Location	Cost
1	Rocky Lane connecting roadway	$208,000
2	Rocky Lane grade crossing	50,000
3	Improve Truck Route	56,000
4	Roadway west from Vetville to Rocky Lane	132,000
5	Roadway east from Vetville to 2nd Avenue	75,000
6	Chain Link Fence -- Rocky Lane to 2nd Avenue West	73,500
7	Rocky Lane overpass	611,900
	Total	$1,206,400

Figure 15 shows the general locations of the recommended improvements. The numbers correspond with the project numbers in Tables 18 and 19.

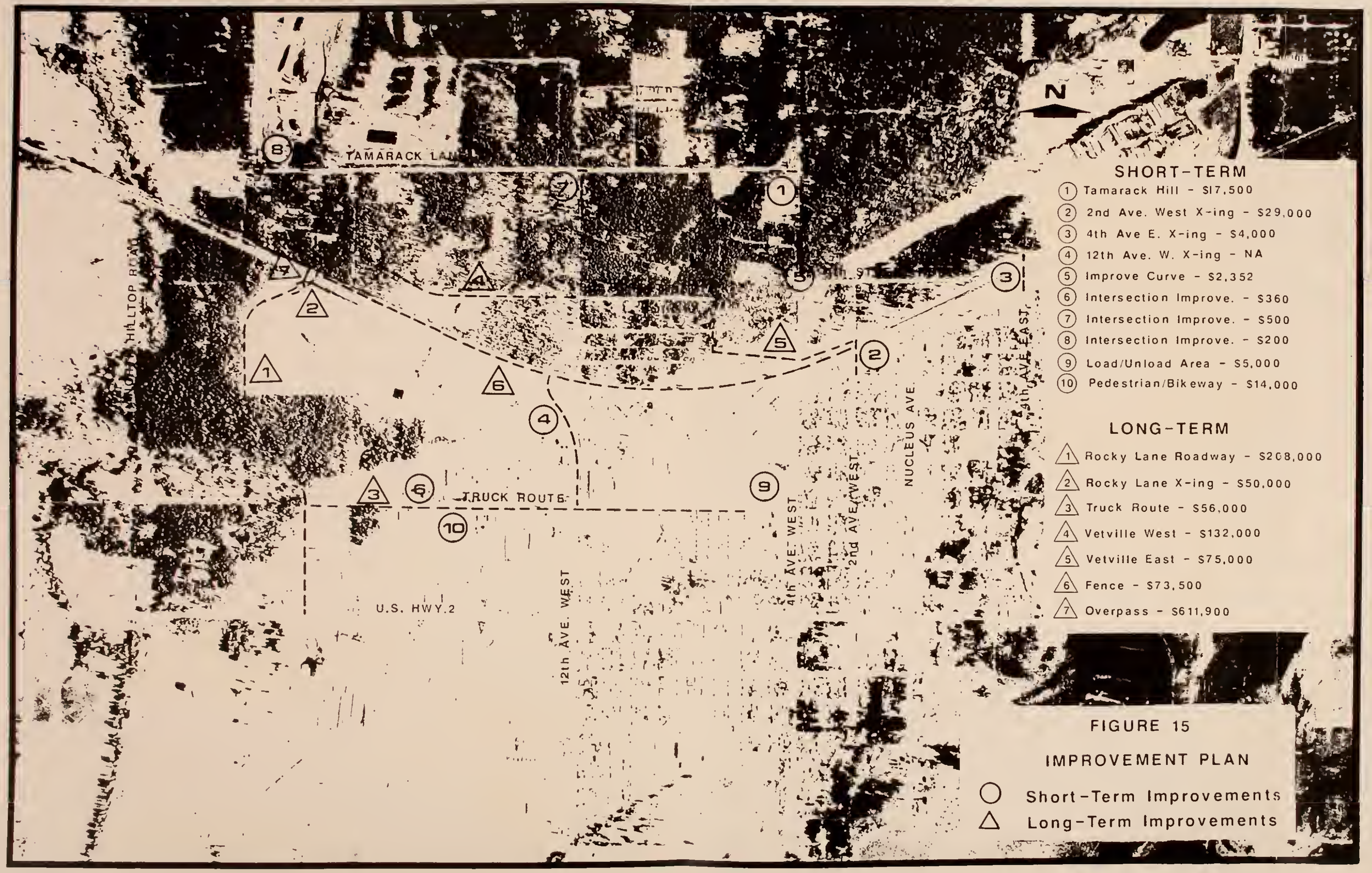

N
TAMARACK LANE
HILLTOP ROAD
TRUCK ROUTE
U.S. HWY.2
12th AVE. WEST
4th AVE. WEST
2nd AVE. WEST
NUCLEUS AVE.
4th AVE. EAST
SHORT-TERM
1 Tamarack Hill - $17,500
2 2nd Ave. West X-ing - $29,000
3 4th Ave E. X-ing - $4,000
4 12th Ave. W. X-ing - NA
5 Improve Curve - $2,352
6 Intersection Improve. - $360
7 Intersection Improve. - $500
8 Intersection Improve. - $200
9 Load/Unload Area - $5,000
10 Pedestrian/Bikeway - $14,000
LONG-TERM
1 Rocky Lane Roadway - $208,000
2 Rocky Lane X-ing - $50,000
3 Truck Route - $56,000
4 Vetville West - $132,000
5 Vetville East - $75,000
6 Fence - $73,500
7 Overpass - $611,900

FIGURE 15

IMPROVEMENT PLAN

○ Short-Term Improvements

△ Long-Term Improvements

VI. FUNDING

IV. FUNDING

The establishment of a funding schedule for planned transportation system improvements is the most uncertain part of this study. Travel and traffic patterns can be estimated based on predictions of future growth and development. The collection and distribution of funds for transportation improvements undergo changes on a regular basis. At the present time, the four year Highway Act is coming to an end. A new Highway Act will be passed in 1986 and could contain legislation that would directly affect the funding of the recommended improvements.

There are several other local, county, state, and federal funding sources that may be used to carry out the recommended improvement plan. These sources have been identified and a general funding schedule has been developed.

Implementation of the short range improvements should be possible within the next two years, using county work force, and private and state funds.

The long range improvements will require cooperation between the public and private sectors.

A. Funding Sources

The following is a list of possible funding sources and the general basis for their availability.

1. Montana Department of Highways: Although all road improvements are on off-system roads, that is, roads not eligible for state or federal aid, improvements to the railroad crossings are eligible for funding under the Railroad Safety Program. To be eligible, it must be shown that the improvement will result in accident reduction. The 2nd Avenue

West crossing meets this criteria and should be eligible for funding under this program.

Relocation of the 12th Avenue West crossing to the Plum Creek West location may be eligible due to the high accident rate at the crossing.

Contact: Robert Champion, Administrator, Program Development Division, Highway Building, 2701 Prospect Avenue, Helena, Montana 59620

2. Flathead County: Flathead County receives a gas tax allocation from the state and cash in-lieu of tax payments on federal lands.

A portion of these funds should be available to carry out several of the recommended short range improvements. The recommended funding schedule also allocates county funds to several of the long-term connecting road improvements.

These would be funded jointly by the county and Plum Creek. Part of this joint agreement would also involve the exchange of ROW and reimbursement for existing roadway.

Based on the prices used to estimate the improvement costs, the ROW through Plum Creek Lumber Company would cost $18,750 and the roadway (new) would cost $50,000. The annual savings in delay time at the heavy equipment crossing would amount to $40,950 in 1985, increasing to $151,510 when Meadow Lake Subdivision is fully developed. These figures may be used as a basis for negotiations between the county and Plum Creek Lumber Company, in arriving at an equitable method for paying for the recommended improvements. Other major generators north of the tracks may also be interested in seeing the improvement plan carried out and may be willing to participate in paying for certain improvements that directly affect them. A rural improvement district covering the entire area north of the tracks would be very difficult to implement due to the varying benefits to individual parcels.

3. Rural Special Improvement District (RID): The county could form an RID which would allow private properties to pay for certain improvements over a period of time.

4. Industrial Revenue Bonds: The county could issue industrial revenue bonds to pay for certain improvements directly affecting Plum Creek or the Meadow Lake Country Club. This would allow payments to be made over a period of 20 years at relatively low interest rates.

5. Local Option Motor Fuel Tax: Recent state legislation allows counties to levy a one or two cent excise tax on motor fuel for road improvements. This would be a countywide tax and road improvements would be made throughout the county; however, the recommended improvement plan could be included.

6. Montana Community Development Block Grant (CDBG) Program: This program is available for the construction of public facilities; however, to date, funds have been distributed primarily for sewer and water improvements.

Contact: Dave Cole, Department of Commerce, Local Government Assistance Division, Community Development Bureau, Cogswell Building (211), Helena, Montana 59620.

7. EDA Grants for Public Works and Development Facilities: This program provides grants for construction and rehabilitation of public facilities necessary to improve community business environments. Due to the impact on approximately 750 jobs at the Plum Creek Lumber Company and 30 to 70 jobs at the Meadow Lake Country Club, certain improvements may be eligible for funding under this program.

Contact: Cornelius P. Grant, Representative for North Dakota-Montana, Economic Development Administration, P.O. Box 1911, Bismark, North Dakota 58502.

B. Funding Schedules

Tables 18 and 19 show funding schedules for the recommended improvement plan for both short- and long-term improvements. Specific amounts to be paid by each funding source are not set forth because, to do so at this time may hinder future negotiations.

Table 20
Short-Term Improvement Funding Schedule

Project Number	Cost	Funding Source				
		Federal	State	County	City	Private
1	$17,500			X		
2	29,000		X			
3	4,000			X	X	
4	NA					
5	2,352			X		
6	360			X		
7	500			X		
8	200			X		
9	5,000			School District		
10	14,800				X	X

Table 21
Long-Term Improvement Funding Schedule

Project Number	Cost	Funding Source				
		Federal	State	County	City	Private
1	$208,000					X
2	50,000		X			
3	56,000			X		
4	132,800			X		X
5	75,000			X		X
6	73,500					X
7	611,900	X	X			X

APPENDIX

TRIP GENERATION
AND
TRAFFIC ASSIGNMENT MODEL

A Trip Generation Model

A trip generation model was developed which was used to estimate existing and future trips by traffic zone within the Columbia Falls urban area.

The following steps outline the methodology used in developing the trip generation model:

1. Using aerial photographs and the existing land use map, the Columbia Falls urban area was divided into thirty-two traffic analysis zones. The zone boundaries were drawn so that, to the extent possible, each zone contained a homogenous land use such as industrial, commercial, residential, etc.

2. Land uses, population, and population characteristics obtained from the Regional Development Office were tabulated for each traffic zone. Building permit records were used to update 1980 Census data.

3. Land use and dwelling unit counts were used to calculate trip productions and attractions for each traffic analysis zone.

4. The model was calibrated by calculating the total number of trips crossing the BN tracks. These estimates were compared to actual, 1985 traffic counts. Trip generation rates were adjusted to duplicate this total volume.

5. Population and dwelling unit projections for the years 1985, 1990, 2000 and for full development of Meadow Lake Estates Subdivision, were distributed to the traffic analysis zones based on the Columbia Falls Planning Jurisdiction Master Plan which was adopted by the City of Columbia Falls and the Flathead County Commissioners in August 1984.

A. Traffic Assignment Model

A traffic assignment model was developed and used to estimate future traffic volumes on the existing and alternative crossings.

The following steps outline the methodology used in developing the traffic assignment model.

1. Using the trip productions and attractions from the trip generation model, zone to zone travel desire lines were constructed. The 1985 zone to zone traffic volumes were assigned to the existing crossing locations and compared to actual traffic counts. The model predicted actual crossing volumes to within three percent. This was considered to be an acceptable calibration of the model.

2. Based on existing and projected trip generation, optimum crossing locations were calculated for the following vehicular and pedestrian traffic scenarios.

   - 1985 vehicular traffic
   - 1990 vehicular traffic
   - 2000 vehicular traffic
   - Full development of Meadow Lake Estates Subdivision
   - 1985 total student crossings
   - 1990 total student crossings
   - 2000 total student crossings
   - Full development total student crossings

3. These optimum crossing locations were taken into consideration in determining alternative crossing locations to be evaluated.

4. The traffic assignment model was used to estimate existing and future traffic volumes for each alternative crossing.